Relative Advantages of Group and Individual Motor Drives—Features of an Automatic Hydroelectric Plant—and Articles on Public and Inter-trade Relations

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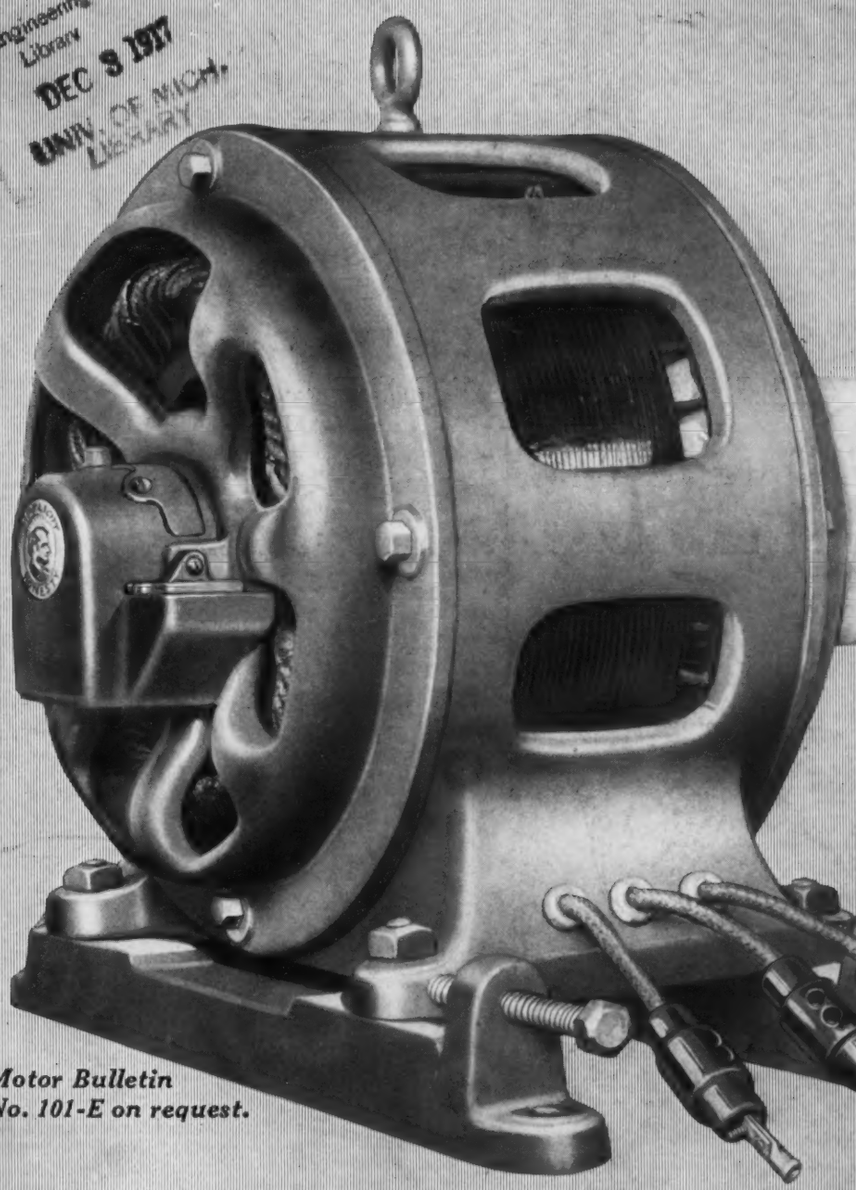

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Electrical World

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Engineering Management of State Affairs

WHEN the Governor of Illinois recently replaced 128 boards and commissions with a business organization of nine departments to handle the public affairs of that State he took a forward step in practical politics and did something commendable from an engineering standpoint, for one of the departments dealing directly with engineering matters is the Department of Public Works and Buildings. There the engineering work is now divided among four technically trained men of high standing in their respective professions, who have been selected without regard to politics and have had a free hand in organizing their departments for efficiency. Thus the operation and maintenance of all existing plants, as well as the design of new heating, lighting, ventilating, power and pumping plants, is brought under the direct supervision of a trained engineer with a capable staff. Undoubtedly this will make for uniformity, efficiency and economy. If now this organization can be permanently kept out of politics, what an excellent example it would be for other state executives to follow and what great possibilities for good and for encouragement it will hold for the engineering profession!

Rural Line Problems

MOST of the problems connected with the operation of rural transmission lines are those of other transmission lines, but there are problems which are peculiar to rural lines or which are at least acute for this type of transmission. Compared with transmission lines which supply industrial centers and cities, rural lines are required to carry relatively small loads per unit of length, therefore the apparatus used for protection must be very inexpensive and at the same time quite durable and reliable so as to reduce the maintenance and service expenses to a minimum. In many cases the operating company is faced with the dilemma of either purchasing expensive oil switches, lightning arresters, etc., the same as for large and prosperous systems, or adopting the alternative of getting along without these things and using crude home-made apparatus, with the resultant interruptions and damage to equipment. The importance and extent of rural transmission systems are certainly sufficient to warrant manufacturing companies and consulting engineers going specifically into the needs of this class of transmission and developing devices which such lines will justify and without which they cannot be operated successfully and economically.

Of the problems existing at present, that of a satisfactory inexpensive lightning arrester is probably the most important one and the most difficult to solve. The arrester must be sufficiently yielding, like a static condenser, to respond instantaneously to a small over-voltage, and at the same time it must act as a check valve promptly and effectively to suppress any power arc which may occur, such arcs usually causing an interruption in service.

Another important problem is that of providing fuses on branch lines which have no attendants at the junction. Such a junction may be miles away from the nearest lineman or troubleman, and long interruptions caused by a ruptured fuse may result in considerable inconvenience to both the consumer and the company. The fuse should preferably be self-resetting and of the magazine type, and it should also be connected with some low-tension system, say a telephone wire, so as to indicate the trouble automatically at the proper supervision point.

The problem of a large charging current on long lines was discussed at length in our issue of Oct. 13, and we need only again emphasize its importance now. The prevention of insulator failure will probably be solved in due time for all overhead transmission lines, but the specific problems which are hampering successful operation of rural transmission lines should receive immediate attention. With the extension and spread of large transmission systems all over the country, these rural lines gradually become parts of huge overland electric plants, and any lack of reliability in their operation will therefore interfere with the successful operation of the ultimate system.

Automatic Hydroelectric Stations

WE HAVE from time to time described several substantially automatic hydroelectric plants designed for work in conjunction with regularly manned stations. The system which we have the pleasure of describing this week is of particular importance as being quite the largest of the kind yet erected and as possessing some unusual features of automatic control. It is a feeder for the transmission system of the Iowa Railway & Light Company and is situated on the Cedar River at Cedar Rapids, Iowa. The hydraulic plant is situated some five-eighths of a mile from the main steam station of the company, to which it is connected by three groups of cables for power, instruments and control respectively. The hydraulic plant is therefore susceptible of remote control in the ordinary sense; aside from being automatic in a much broader sense in its regular operation. From the hydraulic stand-

point the plant is under rather unfavorable conditions, having a somewhat variable head, averaging about 10 ft. (3 m.). The three 500-kw. generators are driven by vertical single-runner wheels at a speed of 60 r.p.m. The generators were wound two-phase, since the main steam plant happens to be equipped with two-phase generators. The current for the excitation of these is furnished by two motor-driven, compound-wound exciters, each capable of handling the whole present equipment of the plant and the extra generator which will later be installed. The plant also contains the automatic control apparatus, although all the instruments are installed at the end of the control cable in the main power house.

The work of starting the station is intrusted to three motor-driven drum controllers which perform all the necessary operations in their regular sequence. When it is desired to start up a machine a drum controller is started by the appropriate bush-button on the remote-control board. Then the following set of operations goes on in order: An exciter set is started by throwing the motor directly across its 2300-volt lines. Then the hydraulic gate motor is started and opens the gates to about one-fifth of full opening. The drum is then stopped until the generator reaches a speed of 55 r.p.m., at which time a centrifugal speed switch closes the contacts to again start the drum, by which the main-line contactor throws the machine, unexcited, in on the line in series with a set of reactances which limit the current during the synchronizing period. Then the field contact is closed in two steps, the protective reactances are short-circuited, and a contact-making ammeter starts the gate motor again and opens the gate to a point sufficient to carry the predetermined load for which the equipment is set. Inasmuch as the station runs entirely without attention except for a visit every eight hours from a station man just off his regular shift at the main plant, special provisions are made for taking care of possible trouble with the machines. The bearings are protected by thermostats set to operate at 45 deg. C. The protective reactances are equipped with thermostats set at 75 deg., and the stator coils are protected for 65 deg. If any of these temperatures are exceeded, the unit is promptly shut down automatically.

To avoid any possibility of the machines running away from dropping the load a 1-hp. induction motor, running light, carries a centrifugal switch set to shut down at 64 cycles, the normal frequency being 60. Under test it is found that this device will start the closure of the gates within a second and a half. A float switch guards against trouble from low water. By similar means the generators can be thrown on automatically with the regular sequence of operations when the head rises to a proper working point, after which they remain in operation as long as the head of water justifies. Ordinarily, however, the station is taken care of by the remote control. Since the plant has been started the engineers have racked their brains to imagine possible conditions which might cause trouble, and each of these, rising to the astonishing number of forty-eight, has been brought about artificially. In every case the plant was automatically shut down until conditions were remedied. Comparatively few changes had to be made in the equipment after the start, really nothing more than a little refinement of some of the automatic operations. The success of this installation ought strongly to stimulate interest in the possibilities of automatic operation already tried out to an encouraging extent in other stations and substations. The saving of labor is a considerable item always, particularly in the case of smaller stations than this in which the labor cost apportioned against the output runs higher than here. For example, cases not infrequently arise in which two or three small water powers, either on the same stream or on neighboring streams, can be made to co-operate and give a conjoint output of very respectable size. If connected for automatic operation, one man per shift may be able to operate with entire success two or three small plants several miles apart, bringing each into service as it is needed and controlling the entire equipment almost as easily as if it were under a single roof. In the example before us the work is on so large a scale and carried out so successfully as to encourage future installations of this very interesting nature.

The Prevention of Accidents

WE ARE publishing this week a very pertinent abstract of a paper before the National Safety Council with respect to lessening the accident risk in electric service companies. The subject is one which is of very definite importance both from the standpoint of proper safeguarding of employees and from that of casualty insurance. In any industrial establishment accidents, serious or otherwise, are likely to be surprisingly numerous. Most of them are utterly trivial, simply recorded as accidents for the sake of completeness. A few are grave or even fatal. Electric light companies are no more exposed to casualties than many industrial organizations engaged in miscellaneous manufacturing in which power and tools find daily use indoors and out. The special risks of the electric company are those which have to do with the direct effect of shock and the secondary concomitant of burns from the electric current. But it is altogether a mistake to suppose that such accidents form any large proportion of the total list in the every-day experience of an electric company. In fact, to judge from some recently published records of one very large company extending over five years past, electrical accidents are altogether the exception. In the case referred to they formed barely over 4 per cent of the complete record. In point of numbers electrical causes of every kind stood rather low among the causes of accidents, as the figure given should witness. For instance, there were more than twice as many accidents from falls as there were from electrical causes. More than twice as many, too, were injured by being accidentally struck by material, while cuts, bruises and sprains made up nearly half the total.

One must therefore dismiss from the mind purely electrical risks as being the commonest sources of difficulty, especially in city stations, but nevertheless elec-

trical accidents run a chance of being somewhat serious, and a considerable proportion of the fatal accidents, always very small with respect to the total, are likely to be due to shock. It is therefore an obvious duty in any electrical service company to pay particular attention to the elimination of the risks peculiar to its business. It is frequently necessary to work on live circuits, sometimes on live circuits of high potential, and the company that does not provide all necessary tools and safety appliances for such circumstances and instruct its workmen in their proper use fails of its plain duty. Public service corporations having widely ramifying high-tension lines must generally exercise exceptional caution in this respect on account of the frequency of conditions that call for working on live circuits. Electrical risks in this class of plants are very much greater than in the regular service of a big city central station. On any high-tension system the only safe assumption is that all live wires are in effect uninsulated. The uninsulated wire is certainly dangerous; the insulated one very likely is not, but may be without showing any signs of its potential dangers.

High-tension and low-tension wires ought to be carefully distinguished from each other, and those carrying dangerous voltage should if possible either be completely inaccessible except over very limited stretches or be out of reach and plainly traceable so that no doubt may exist as to their identity. On circuits carrying either very high voltages or very heavy currents careless switching is a prolific source of danger, and no employee should be allowed to take a hand in the switching operations without knowing exactly what he is about. Modern remote-control systems eliminate a good bit of this risk, but there are many places about a plant where danger may exist if switches are incautiously handled. Switchboards in particular are often too crowded for space in the rear, so that dangerous, although perfectly innocent-looking, wires cannot be readily distinguished unless so plainly marked as to be visible at the most casual glance. Instrument leads need particular attention, as was put in evidence not long ago when a single inquisitive long-tailed rat ran foul of a potential transformer and started an arc that put the lighting of a whole city temporarily out of business. Proper care in high-tension wiring and proper tools for work upon it get rid of the most dangerous, although not the most numerous, chances of accident in electric service. The data quoted in the article before us show that the chances of fatal accidents are by no means at a maximum in the electrical industries.

Machine-Tool Driving

ANOTHER of Professor Clewell's pointed articles considers in some detail the relative advantages of the group and individual drive for machine tools touched upon in our last issue. Speaking in very general terms, the advantages of individual drive are in lessened constant losses in the power supply, in extremely facile control and in the independence which may be secured in the placing of various machines. The contrary factors are enhanced first cost of individual motor drive, particularly in machines requiring motors of small output, and the consequent gain from dispensing with separate motors altogether in the cases where a number of machines are operated simultaneously like a unit and practically at full load. There are also collateral advantages from belt drive including a number of machines in cases where each individual machine is subject to extreme changes of load which in case of a separate motor would require such high overload capacity as to increase the cost and decrease the efficiency. The friction losses due to shafting in an ordinary machine shop are rather large—at least 25 per cent on the whole, and often 30 per cent. This therefore gives a reasonable opportunity for actual saving of power by the use of individual motors.

In the somewhat exceptional cases where the power cost of an operation is a very material factor this saving might of itself be enough to justify the individual drive, but, as Professor Clewell indicates, there is very much to be said for the separately driven machine merely from the standpoint of that flexibility which means increased output. Anything which can cut down the relative importance of the element of human labor should in these days be sought earnestly, and if by the use of carefully regulated electric drive the speed of operations can be increased and the finished product delivered with less time spent with the laborer, there is a very definite gain irrespective of whether the work is piece work or day work. In the one case there is, of course, a direct saving in cost of labor, in the other an indirect saving by that increased production which raises the efficiency of the whole shop. Beyond this there is in the individual drive the advantage on which we laid stress in commenting on Professor Clewell's previous article.

The balance of the argument therefore stands in a large percentage of cases in favor of the individual drive, save in the operation of small and homogeneous groups of machines under nearly constant load and a few exceptional cases of extremely variable load.

The Coming Issues

OPERATING subjects which should be of interest to many engineers will be discussed in the next issue of the ELECTRICAL WORLD. Among the articles which will be presented will be one on the question of increasing present steam pressures with an estimate of the increased cost of equipment and curves showing improvement in water rates and thermal efficiencies. The sixth installment of Prof. C. E. Clewell's series on industrial motor and control applications will dwell on the considerations that should be given speed, torque and power relations in machine-tool work. Emphasis will be placed on the remarkable changes wrought by the introduction of adjustable-speed motors, and some of the limitations on the use of constant-speed motors will be outlined. Special attention is directed toward an article by James F. Pollard in which are discussed service extension problems in California.

Features of an Automatic Hydroelectric Plant

Rise of Water Level Causes Proper Number of Generators to Start to Utilize Water Most Economically—Simplicity of Construction and Arrangements for Supervisory Control in Emergencies

A HYDROELECTRIC generating station which is entirely automatic in all of its operations has recently been placed in service by the Iowa Railway & Light Company on the Cedar River, only a few blocks from the business district of Cedar Rapids. The plant, which will have an ultimate capacity of 2000 kw., operates in parallel with an extensive transmission system which already reaches practically across the State of Iowa, except for a 28-mile (45.06-km.) break near Marshalltown. There are no instruments in the hydroelectric plant, these being installed in the company's steam station, which is about 0.6 mile (0.97 km.) distant. Three groups of conductors—power cables, instrument cables and control cables—connect the two plants; hence, while the hydroelectric station is self-controlled and entirely automatic, it is possible for the steam-plant operators to supervise the action of the waterwheels and generators.

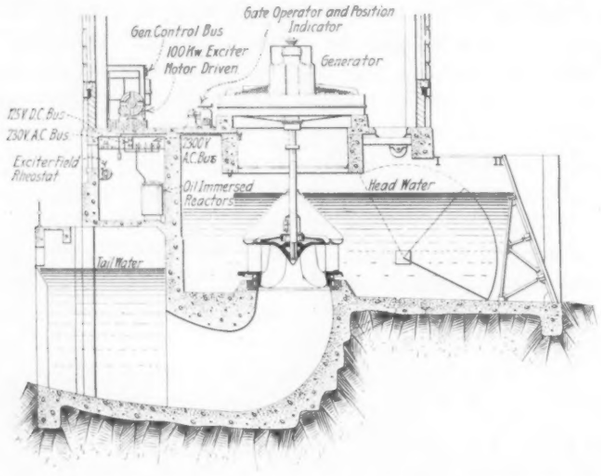


FIG. 1—USE OF TAINTER GATE AND POSITION OF BUSES WITH RESPECT TO CONTROL CABINETS

Perhaps the most spectacular and surprising feature of the whole plant is the speed with which the station goes into service. It requires just thirty-seven seconds from the time the first switch operates until the first generator is under full load. A somewhat formidable array of mechanism might be expected in a plant of this nature, but the contactors and switches are inclosed in cabinets and the buses and control wires are run through bus chambers beneath the floor, so that the interior of the station appears very simple. With this arrangement, and by making each generator and its circuits, except for excitation, an independent unit, every element of the wiring and control apparatus has been made readily accessible.

The excitation for each machine is maintained at a fixed value at all times, thus simplifying the excitation problem, eliminating the necessity of voltage regulators, making it possible to take advantage of the full capacity of the river, and at the same time improving the power factor of the system through the operation of underloaded, overexcited machines. No oil governors are used for any of the machines, the gates being operated by motors which are upon complete automatical control at the hydroelectric station or remotely controlled from the steam station.

Either Automatic or Remote-Control Operation Is Possible

In general, the operation of the plant may be managed in either one of two ways. In either case the plant operates automatically, but in one case the control is vested in float switches and contact-making ammeters in the hydroelectric plant, while in the other case it is vested in remote-control switches on the benchboard at the steam power house. With the plant under the control of the float switches, the generators are automaticaliy started as the head of the dam rises above certain definite levels owing to the increasing supply of water and the rising of the automatic flashboards. Likewise, the machines are automatically stopped if the head is lowered. With this system as many machines will come into operation and remain in operation as the supply of water justifies. Through the control on the benchboard at the plant, however, it is possible to start any or all of the machines at any time and to control the gate opening and load on any machine at any time.

As a rule, the latter plan of operation will probably be followed, running as many machines during the daytime as it is possible to operate and still permit the river to store up water for use at night. Then during the night the entire hydroelectric plant will be in operation under the control of the operators at the steam plant. This method of operation has been selected as that which fits in best with the conditions on the system. With all three machines at the hydroelectric station operating, one boiler at the steam station may be shut down at night.

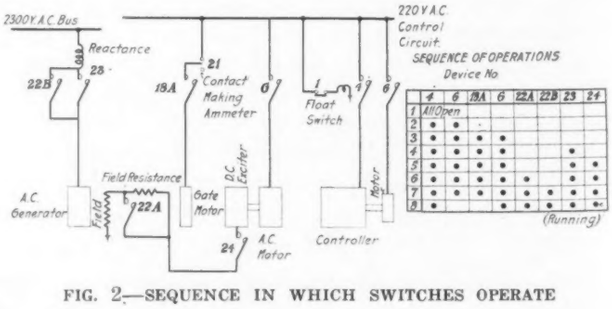


FIG. 2—SEQUENCE IN WHICH SWITCHES OPERATE

The hydroelectric plant is a particularly valuable adjunct as a safeguard against interruption to service. For instance, if one of the large turbine units in the power house loses its vacuum it will be possible for the operators there to place 1500 kw. of hydroelectric capacity on the line in less than a minute by the oper-

ation of three buttons on the benchboard. Moreover, the operator who pushes these buttons need not stand at the benchboard and wait for the hydroelectric plant to come to the line, but can immediately leave the benchboard for the vacuum pumps and assist in getting the steam turbine back on the line promptly.

Another unusual operating plan is made possible by the fact that the excitation furnished to the hydroelectric machines is of a constant quantity. For example, in case there is enough water flowing in the river to permit the operation of one machine at full load and to produce 100 kw. on another, full use can be made of the water and of the windings on the second machine by taking the control away from the contact-making ammeter and using the underloaded hydroelectric machine to absorb a large part of the wattless component of the system load. This, of course, will greatly help the power factor of the system.

THE HYDRAULIC EQUIPMENT

The normal head at the plant is 10 ft. (3.04 m.), but the head may vary from 8 ft. (2.43 m.) to 11 ft. (3.35 m.). Records which have been taken to ascertain the characteristics of the river show that during 180 days out of 365 the average discharge is about 2100 cu. ft. (59.4 cu. m.) per second. The lowest flow per day is 500 cu. ft. (13.15 cu. m.) per second. This low-water period lasts for about four days in the year. The maximum flowage of the river is 50,000 cu. ft. (1315 cu. m.) per second, about twelve or fourteen days in the year being flood days. These flowage data should be considered in connection with the fact that each runner in the plant takes 720 cu. ft. (22 cu. m.) of water per second, three 500-kw. units now being in service.

The dam is composed of nine 60-ft. (18.28-m.) spillway sections, each of which automatically rises and falls with the flowage of the river, giving an automatic flashboard effect. Four motor-driven Tainter gates are installed at the intake to the flume. The wheel pits at the power house are independent of each other and are equipped with 20-ft. (6.09-m.) Tainter gates on the upstream side and stop logs on the downstream side. This makes inspection easy, and did not complicate the layout or cost much more. The water-wheels, which are of the Francis single-runner type, measure 171 in. (435.9 cm.) in diameter and are rated at 540 brake-hp., 60 r.p.m., and 84 per cent efficiency under a 10-ft. (3.04-m.) head. This type of wheel was chosen since they must necessarily operate at low speed, and since it was desirable to install direct-connected units. Having had previous experience with wheels made by the Allis-Chalmers Company, the operating company decided upon that manufacturer's equipment. The thrust bearings on the machines are of the Allis-Chalmers plate type, which is a modified Kingsbury bearing. The oiling system is driven by a direct connected pump, Uresel oil being used exclusively. The oil will need replenishing about four times a year.

THE ELECTRICAL END OF THE STATION

The generators are two-phase, 60-cycle, 60-r.p.m., 2200-volt, 109-amp. (per phase) vertical Allis-Chalmers machines, and are arranged in a single row. Two-phase units were selected because the company's large steam plant still operates two-phase. There would be little difference between the control in this hydroelectric station and that in a three-phase plant, since a four-wire system would be used in either case. Two induction, motor-driven, compound-wound interpole exciters, each capable of exciting the ultimate equipment in the plant, are installed.

The control cable, which consists of fifty-two No. 12 rubber-covered wires in a lead sheath between the hydraulic and steam plant, was not combined with the instrument cable, as breakdown in one of the current transformers might apply a high potential to the control circuits. Of the fifty-two wires in the control cable, thirty-eight are used for indicating the gate positions. All cables between the plants, some 3300 ft. (1005.8 m.), were laid underground to guard against lightning.

The control equipment at the hydroelectric plant consists of standard control apparatus, much of which is of the so called steel-mill type. This type of equipment was selected because it is rugged and is not too sensitive. Hence, while the plant itself is something entirely new in the field of hydroelectric development, its greatest feature, the automatic control, consists of an assembly of standard equipment arranged to perform special duties. The control equipment is assembled on three generator control cabinets and one exciter control cabinet, a fourth cabinet serving as a terminus for all control and instrument wires. The instrument wires and transformers are so arranged that it is possible to "cut in" portable instruments, this being considered advisable since there are no permanent instruments at the hydroelectric plant. In addition to the equipment mounted on the cabinet boards there are three motor-driven drum controllers which control the sequence of operation of the remaining control equipment, thus preventing mistakes.

Starting with the station at rest, the only live parts in the plant are the control transformers and the induction-motor speed-limiting device. To begin with buttons Nos. 1, 2 and 3 on the benchboard in the steam plant, which are normally open, are closed. The drum controller then starts to run. The action to this point could also be accomplished by the action of automatic

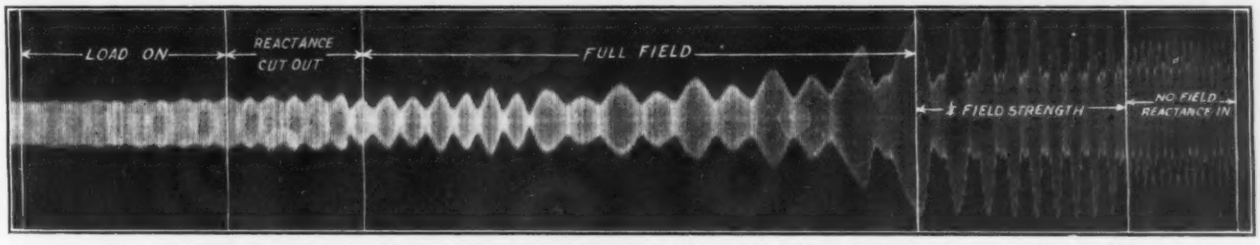


FIG. 3—OSCILLOGRAM OF GENERATOR CURRENT DURING STARTING PERIOD (PEAK VALUE OF CURRENT IS 234 AMP.)

float switches if the plant were being operated on that plan. The first function the drum performs is to start one of the exciter sets. The 150-hp. motor of this set is thrown directly across a 2300-volt line. It comes up to full speed and full voltage in 3.5 seconds. The motor, in starting, takes eight times full-load current momentarily. The drum continues to run, and closes the necessary contact to drive the gate motor, which opens the gates on the waterwheels to about two-tenths full opening. The control circuit is then de-energized and the drum stops until the generator reaches a speed of 55 r.p.m. At this time a centrifugal speed switch on the top of the generator shaft makes a contact which closes other contacts to start the drum again.

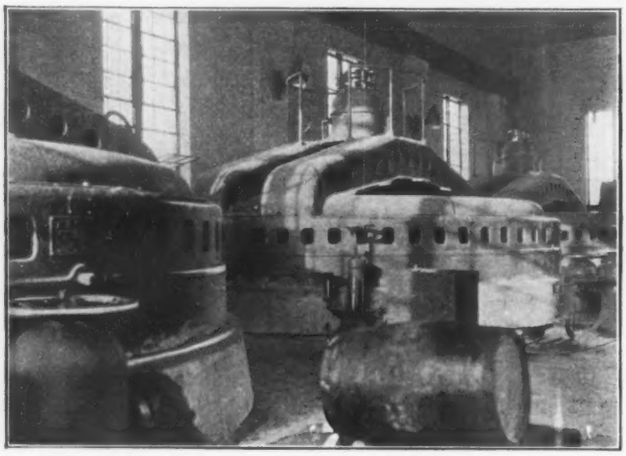


FIG. 4—THREE GENERATORS IN IOWA AUTOMATIC HYDROELECTRIC STATION

The functions next performed by the drum are: First, the main-line contactor is closed, putting the machine in on the line without excitation, and in series with a set of reactors which limit the generator current to about two and a half times full-load current during the synchronizing period. Two of these reactors, which are of the single-phase, oil-immersed type and are designed for five-minute duty, are installed with each machine. The time element between the closing of the speed switch on the main generator and the closing of the main-line contactor is of such an interval as to permit the generator speed to increase from 55 r.p.m. to 60 r.p.m., or synchronous speed, before the main-line contactor closes. The next function performed by the drum is to close the field contactor, the field rheostat being divided into two sections, so that when the field is connected with the line the current is only approximately one-fourth its normal value. Next, the drum closes the contactor, which shunts out a section of the field rheostat, increasing the field current to its normal value. Then current-limiting reactors are short-circuited, and the contact-making ammeter closes a circuit actuating the gate motor, which opens the gate to a point that will permit the machine to carry a predetermined load.

Since the station is to be left attendantless except for one visit every eight hours by an employee just off shift at the steam plant, it must take care of its own cases of trouble, if any arise. To that end the machines are protected against hot bearings by thermostats of the spiral-spring type installed on each bearing. These thermostats are set to operate at 45 deg. C. In common with all other thermostatic control in the station, these bearing units operate to shut down the machine affected entirely and keep it shut down until conditions again become normal, when the machine will start of its own accord. Thermostats are also placed on the current-limiting reactors and are set to operate at 75 deg. C. Thermostats on the stator coils of the generators are set to operate at 65 deg. C. The speed-limiting device consists of a 1-hp. induction motor running light, with a centrifugal switch attached to the end of its shaft. When the frequency of the station reaches 64 cycles the centrifugal switch operates to shut down the plant. To test out this device the main oil switch at the steam station was tripped from the benchboard, cutting all load off the hydroelectric plant, which, of course, would tend to make it run away. In 1.4 seconds after the oil switch was tripped the frequency-limiting device had operated and the waterwheel gates were beginning to close.

Single-phase operation is prevented by the fact that a part of the relays are in one phase and a part in the other, and the wiring is laid out so that any one of the relays opening will open all contacts and shut down the machine. Of course, no voltage failures on alternating current are guarded against, since under these conditions there would be no energy to hold in any of the contactors. The loss of excitation is guarded against by a relay in series with contacts which in opening shut down the plant. The machines are protected against surges by a time element in the setting of the relays, which under abnormal conditions cuts the reactors into circuit for an interval before the machine goes off the line. Ordinarily, two 5-kva. type H transformers furnish energy for the control. In case of an emergency, however, a throw-over switch connects the steam station power and lighting transformers with the control circuit.

The float switches guard against trouble from low water. No special provision has been made to guard against frazil ice, and the only precautions taken in guarding the water supply are standard trash racks at the intake to the wheel pit and at the intake to the flume. It is interesting to observe in this connection that a sudden stoppage of all units in the plant produces a water-hammer effect in the flume, piling this water up at the gates to such an extent that the

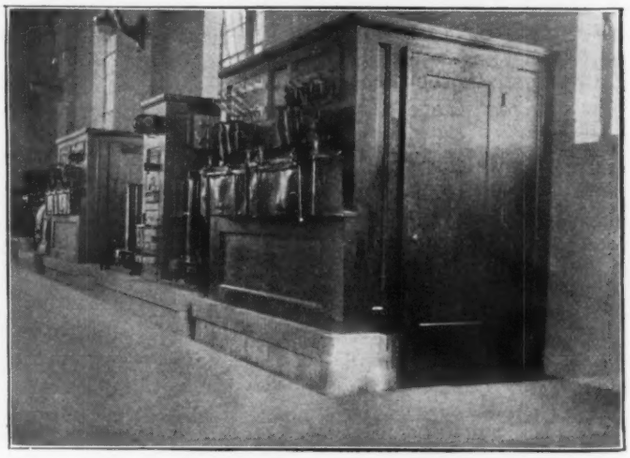


FIG. 5—GENERAL VIEW OF CONTROL CABINETS WITH CONTROLLERS BETWEEN

back wash effectively clears all trash from the racks and causes material which has gathered at the upsteam trash rack to be washed over the spillways.

Since the plant has been in operation the engineers of the central-station company and of the manufacturing company conceived forty-eight conditions and combinations of conditions which might occur to cause trouble at the plant. Each one of these conditions was brought about artificially, and the result in each case was the automatic shutting down of the plant until normal conditions were restored. In these tests everything from dead short-circuits to exciter failures was tried out.

One of the striking things about the design and construction of this station was that relatively few changes were necessary in the original layout in order to make the plant operate as planned. The changes consisted of the addition of four relays. One relay was added to short-circuit the exciter-field rheostat to make the exciter set come up to voltage as fast as it came up to speed. This provision was thought wise in that the failure of the exciter to come up to voltage rapidly might necessitate making the control drum revolve twice before the generator could be put on the line. Relays were also placed so that shutting down or starting up of any one of the generators would stop or start an exciter set. The addition of these relays makes it possible to shut the machines down in any sequence or to start them up in any sequence, the first machine started up always starting the exciter set and the last machine shut down always shutting down the exciter set.

HISTORY OF THE DEVELOPMENT

The preliminary work on this water power was being done at about the time Taylor and Allen were working on the automatic rotary converter substation at Union, Ill. (See *Proceedings A. I. E. E.*, Vol. 34, Part 2, page 1801.) The original idea at Cedar Rapids was to install a station with remote control and operate it from the steam plant very much in the way that the

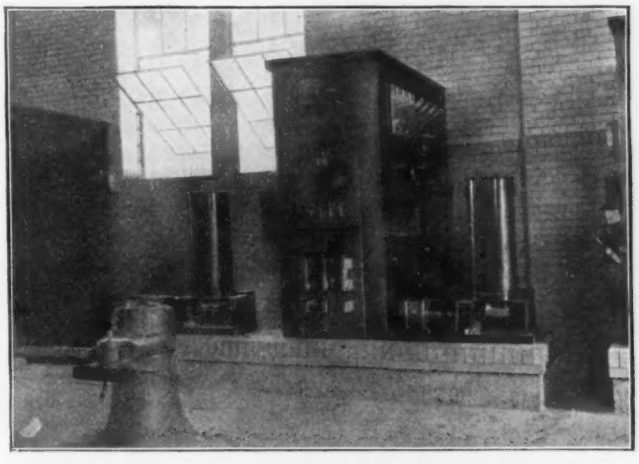


FIG. 6—AUTOMATIC CONTROLLERS AND EXCITER CABINET WITH FREQUENCY-LIMITING DEVICE AT TOP

so-called automatic substations at Detroit are operated. Such an arrangement was finally considered inadvisable, as it involved many complications and provided too great an opportunity for an operator to make mistakes. It was believed that by installing an automatic plant there was an opportunity to effect a saving of some $3,600 to $4,000 a year in labor. Owing to the fact that apparatus already standardized has been used exclusively, and to a rather liberal policy of the manufacturer in absorbing such development charges as were necessary in working up the layout, the actual investment in this plant is no greater than

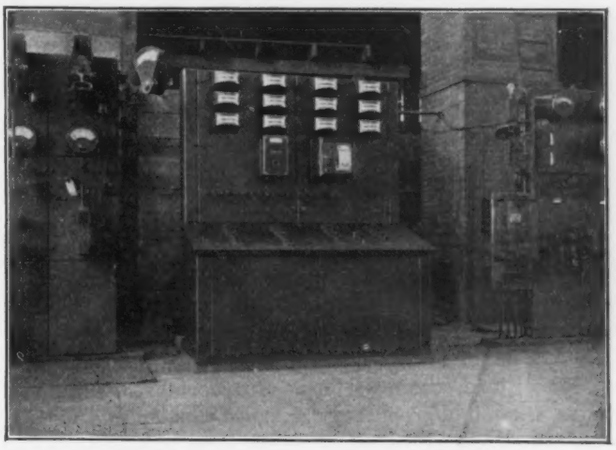


FIG. 7—BENCHBOARD AT STEAM STATION FROM WHICH AUTOMATIC HYDROELECTRIC PLANT MAY BE SUPERVISED

would have been required for a first-class manually operated station.

The design and construction of the station have been carried out under the direction of John M. Drabelle, electrical engineer of the Iowa company. Of the manufacturing company's representatives, L. B. Bonnett and A. C. Thompson of the General Electric Company have contributed liberally of time and experience in getting the station under way. The hydraulic engineering was carried out by the Fargo Engineering Company of Jackson, Mich. The turbines and generators were furnished by the Allis-Chalmers Manufacturing Company, while the control equipment, exciter set, transformers and underground cables were supplied by the General Electric Company.

Tungsten Wire Patent Upheld in Germany

According to the *Elektrotechnische Zeitschrift*, the German patent No. 269,498 (1910), granted to the Allgemeine Elektricitäts Gesellschaft, with priority from Oct. 6, 1909, on claim 1 and from Feb. 23, 1910, on claim 2, has been upheld successfully against the annulment suit brought by the Wolframlampe A.G. (Augsburg), the Radium G.m.b.H. (Wipperfurth), and the J. Pintsch A.G. (Berlin). The text of the actual claims is: (1) Process for manufacturing tungsten wire for electric glow lamps, characterized by coherent pieces of tungsten being subjected to mechanical "working" until they become flexible and ductile at ordinary temperatures; (2) use of initial material in the form of a comparatively coarse powder, the porous body formed therefrom being heated to a very high temperature. Opposition to this patent and the subsequent action contesting its validity were based on the contention that prolonged mechanical working was a well-known means of securing flexibility and ductility in metals, and its application to an individual metal (tungsten) not previously considered ductile was not sufficient ground for granting patent rights. The courts did not support this view.

Safety Methods in the Electrical Industry

Rules, Practices and Precautions That Should Be Observed—Instruction to Employees Must Supplement Mechanical Appliances—Hints from Michigan Company's Experience

BY H. J. BURTON*

Consumers' Power Company, Jackson, Mich.

FIGURES taken from the records of several public utilities show that 55 per cent of the accidents to employees are caused by falls, handling tools or handling material and that only 7 or 8 per cent are due to electric current, but the accidents due to electric current are the serious ones and in most cases are fatal.† It is not the purpose of this paper to disregard the importance of looking after and trying to prevent the minor accidents, as it is realized that in the aggregate they are important. Slight injuries which are neglected are liable to become serious. Furthermore, slight injuries should be reported as they sometimes indicate that something is radically wrong and needs attention before a serious accident does occur. However, it should not be forgotten that the serious accidents incident to the operation of electric generating stations and substations are due to the electric current and not to causes that are common to all industries. In accident prevention work it is not always the number but often the nature of the injuries that should receive most attention.

In some industries, with mechanical protection properly designed and placed, it is possible so to safeguard some machines as virtually to eliminate the serious accidents incident to the operation of the machines. In the electrical industry it is not always possible to safeguard and protect mechanically the equipment used to generate, transmit and utilize electricity. A wire that is energized does not look different from one that is not energized, and the electrical worker must learn what is safe to touch and what should be given a wide berth.

Instructions Must Supplement Appliances

In the operation of electric generating stations and substations it is necessary at times for switchboard operators, linemen and other employees to handle live equipment and lines, and in order to do this safely they must be properly qualified for the work they have to perform. Instructions to employees as well as mechanical safeguards to apparatus are essential if accidents are to be avoided.

Employees should be taught that high-potential currents are dangerous to life, and they should know the voltage carried by every conductor in their station or under their supervision. They should be instructed that not only the bare conductor but the insulation on high-voltage conductors should not be touched or approached too closely. A wire insulated for and carrying a potential of 110 volts might be, and is, reasonably safe to handle; but the same or a similar wire carrying a potential of 1000 volts, although to all appearance perfectly insulated and harmless, would be extremely dangerous to handle, and the higher the voltage the greater danger to life. It cannot be too often repeated or too strongly impressed upon all employees that insulated as well as bare cables or wires carrying high potentials are dangerous to handle or approach unless they are inclosed in a grounded metal sheath. Insulation on high-tension conductors gives a sense of false security to the uninstructed, and many serious accidents to employees have occurred because such a conductor was thought to be safe.

Opening and Closing Switches

Employees are often injured, sometimes seriously, in opening or closing circuits. Accidents of this kind are generally due to haste, forgetfulness or lack of instruction. Employees must know the proper sequence of switching necessary to start and stop machines safely and to connect or disconnect apparatus from its source of energy. Opening or closing a switch or circuit in a power station may be extremely dangerous if not properly performed, and many an employee has had his hands, face and eyes injured by the electric arc resulting from an error in switching. "Think which and then switch" is a good slogan for switchboard operators.

Goggles should be worn when there is any danger of the eyes being flashed by an electric arc. It has been demonstrated that a pair of plain glass goggles will protect the eyes from the injurious effects of a momentary electric arc, and they are more suitable than colored glass goggles as they can be worn with more comfort to the eye and around tight places where colored glasses might obstruct the vision and introduce a stumbling hazard.

Employees should be taught how to replace fuses. The safe way depends upon the voltage of the circuit and the location and kind of fuses. After replacing a low-voltage fuse care should be exercised when closing switch as there is always danger of the fuse exploding and causing injury to the operator's face or hands. Circuits on which drop cords are used and handled should always be lightly fused, so that should trouble occur on a cord that is being handled the fuse will blow readily and possibly prevent a serious burn or shock.

Great care should always be exercised when replacing high-tension fuses such as those used on instrument transformers. Fuses of this kind are generally installed in out-of-the-way places, but can be replaced safely while the circuit is alive with insulating tongs of proper length. On extra-high-voltage circuits insulated stools or ladders should be used in addition to the tongs.

Employees should be instructed not to work immediately above live lines or equipment, because a tool, rope or branch of a tree dropped across a high-tension line might result in a flash which would flare upward with serious consequences. The rule "Work from below" is a good one.

The use of steel measuring tapes should be forbidden around power stations, and employees should be instructed to use due care when carrying or using metal

*Presented before the National Safety Conference, New York City.

†See report of accident prevention committee of N. E. L. A.

rods, tools or articles of any kind around live conductors. Accidents have occurred when articles carried over the shoulder have come in contact with live or moving parts.

Station employees should be provided with protective devices for handling live parts so that they will not resort to makeshifts that are inadequate for their own protection, and they should also be instructed how to use the devices provided. For instance, if a long-handled switch hook is provided for some high-tension disconnecting switches, the operator should be instructed to get the length of the insulating rod between him and the live parts and not to take hold of the rod in the middle. He should be instructed to keep the rod, when not in use, in a convenient and dry place and it should be used only for the purpose for which it is provided. Instances are on record where high-tension switch hooks have been painted with metallic paint and defective or broken rods have been replaced with ordinary broom handles, rendering their use dangerous.

The practice of using the bare fingers or hands to determine whether or not a low-voltage circuit is alive is dangerous and should be discontinued. The very fact that a test has to be made indicates that the circuit is in trouble and may be crossed with a high-tension wire.

New employees should be instructed not to replace fuses, change brushes, clean commutators or do any work on or around live parts unless they have received special permission to do so from their superior officers. Serious accidents have occurred to new men because they have attempted to do something they have seen some one else do safely. For example, it looks easy and is reasonably safe for an experienced man to change a brush on some low-voltage direct-current generators; but a new man might easily receive a serious injury doing so unless properly instructed.

Great care should always be exercised when using private telephone lines that parallel high-tension lines. Insulating transformers, fuses and insulated platforms should always be used, because when there is transmission line trouble the telephone is liable to be highly energized and dangerous.

CARING FOR LIGHTNING ARRESTERS

Electrolytic lightning arresters, which are now used almost universally on high-tension installations, need attention at least once daily, and they are reasonably safe to take care of if they are correctly installed and the operators properly instructed. Numerous instances are on record where arresters of this type have not received proper attention because an uninstructed employee was afraid to perform his duties in connection with them and have been left uncharged for long periods, the arresters being rendered practically useless as a protection against lightning and dangerous to other employees should they attempt to charge them.

All circuits, lines and switches should receive a distinguishing name or number and should be plainly and conspicuously marked, and employees must learn the names and location of the switches so as to be prepared to do emergency switching when life or property is in danger. It is a good plan to designate switches and lines with a letter and a number such as A—1 or the B—2 line or switch instead of the north or south line as the case may be. Serious accidents have occurred when employees have operated the wrong switch.

The public, and especially children, should be instructed through the newspapers and schools not to interfere with electrical equipment or lines. Quite often young "would-be" electricians are allowed to attempt repairs on defective equipment that should be handled only by experienced employees, and boys have been killed while climbing poles for birds' nests. Children flying kites with wire attached have been injured by the wire coming in contact with electric lines.

The prone-pressure method of resuscitation from electric shock should be taught all employees. In addition to being prepared for emergencies, the teaching of this method seems to emphasize the presence of danger and makes employees more careful and keeps them from getting shocked. Resuscitation should be tried in all cases, as accidental contact is nearly always imperfect and the voltage received doubtful.

SAFETY IN THE BOILER ROOM

Regular, frequent and careful inspections of boilers, externally and internally, for defects and weaknesses of material, also the inspection for defects in operating conditions of all auxiliaries, are among the best ways to insure safety around a boiler room.

Gage glasses should be properly protected so that flying particles will not injure eyes of attendants should they burst, and the guard should be such that it will not obstruct a clear view of the water. It is generally necessary to remove the guard while replacing a broken glass, so care should be taken that an accident does not occur before the guard is replaced. Water in the glass should be blown down frequently to prove that it is working all right and is not plugged up. Gages should be well lighted and water tenders should be subjected to an eyesight test. A man with defective vision is not competent for a job of this kind.

In working around all kinds of stokers men using wrenches and bars should be careful that they are in a safe position before straining on the tools. Manhole plates in the floor should be placed securely in the holes and made to fit.

Because of the danger of being burned by hot pokers and slice bars and other irons which are used on the fires, firemen should be careful in handling these bars to see that they do not swing around and hit somebody. When they are removed from the furnace they should be placed in the racks provided for them.

Before any one is allowed to go into a boiler or furnace the head fireman and water tenders should be notified and steam valves and blow-off valves should be tagged "Man in boiler." It is important that the insulation on the portable extension lamp cords used by repairmen in and around boilers should be extra heavy, and the voltage used should not exceed 110. Cords should be carefully and regularly inspected for defective insulation. The ash pit and basement of all boiler rooms should ge kept well lighted.

In conclusion it may be stated that the electrical industry at the present time is about fifth on the list of industries when it comes to fatal accidents. Nothing is more clear than that hazardous places and unsafe practices swell the chances of accidents and death; and if we are to have fewer accidents, we must decrease the hazards as much as possible with mechanical safeguards and lessen the number of unsafe practices by educational methods.

A Study of Group and Individual Motor Drives

Conditions Under Which Group Drive Is Favorable—Advantages of Individual Drive—Increased Production an Important Factor That Should Not Be Forgotten

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—While the advantages of individual motor drive for large machine tools are generally conceded, there are differences of opinion concerning the wisdom of an investment in such equipment for medium or small-sized machinery. One of the purposes of the present article, therefore, is an analysis of the relative advantages of the individual and group methods of machinery drives with conclusions based on the merits of each case. While the article points to the savings which may be effected by the elimination of line shafts and belts, it emphasizes other more important economies which should determine the policy to be followed in any given case.

WHILE there is a marked tendency at present among the leading machine-tool plants toward individual-motor drive, particularly for the larger machines, there is also a tendency to sell a much larger proportion of smaller machines for belt drive, it not being generally agreed so far whether the investment for individual motors for small tools is warranted.

As a basis for an analysis of these two methods of electric drive, it should be noted at the outset that the power consumption of a typical machine tool is usually a relatively small item in comparison with the other charges against the machine (Fig. 1). Any degree of saving in the power consumption will have a relatively small effect on the total cost of production by this tool, whereas any saving in wages brought about by the ability of the operator to perform a given operation in less time will obviously tend to a much greater effect on the cost of production.

The interest and depreciation on a machine tool together may form an item of importance. In this connection Fig. 2 indicates that the cost per horsepower[1] increases rapidly for the smaller sizes of motors; hence the fixed charges on the smaller machine tools when equipped with individual motors are relatively higher than with larger tools where the rating of the motor is higher.

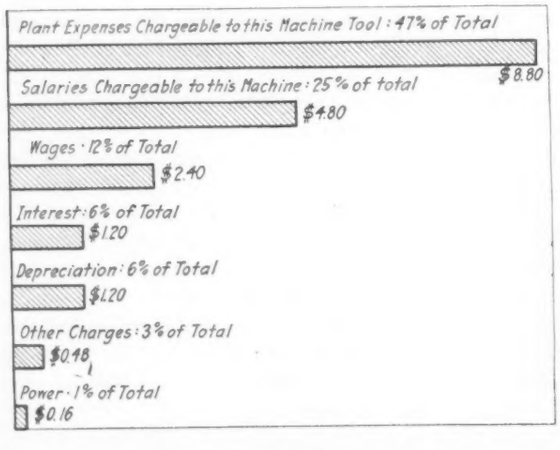


FIG. 1—RELATIVE AMOUNTS CHARGEABLE TO A GIVEN MACHINE TOOL PER EIGHT-HOUR DAY FOR DIFFERENT ITEMS WHICH MAKE UP TOTAL PRODUCTION COST
(Based on data of A. G. Popcke, *Electric Journal*, December, 1907.)

While the use of individual motors can hardly in any case be justified solely on a basis of power saving, any reduction in the power required to drive a given machine is a factor in the gross efficiency of the plant. Table I, therefore, is of considerable interest because it shows the friction losses connected with the line shafting in various typical shop departments.[2] The losses given show the order of magnitude which may be reached, and hence give an indication of the economy which may be effected by the substitution of motor drive for any system of mechanical power distribution.

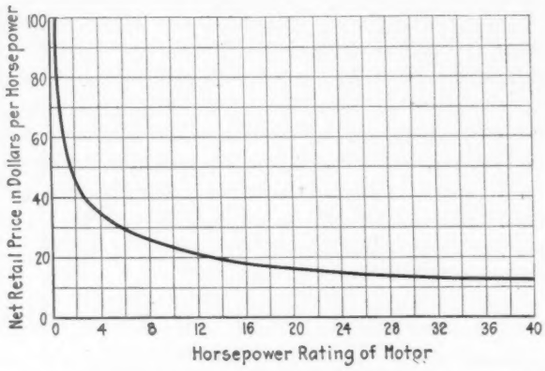


FIG. 2—APPROXIMATE VARIATION IN COST PER HORSEPOWER FOR DIFFERENT-SIZE MOTORS

CONDITIONS FAVORABLE TO GROUP DRIVE

In a general way the term "group drive," as here used, relates to those cases where one relatively large motor supplies a group of machine tools through line-shafting and counter-shafting, the sources of power thus being placed at load centers and the total supply being broken up into relatively small units. The excessive mechanical losses of the long main-line shafts usually employed with purely mechanical power distribution are thus reduced by the electrical distribution up to the group motors, but the mechanical losses usually present with line-shafting and belting still occur between the group motor and the machine tools to which it supplies power.

Several fairly well-defined conditions occur under which group drive is usually preferable to individual-motor drive, and these may be listed as follows[2]:

(a) Group of machines operated at constant speed, all machines being in operation simultaneously.

(b) Machinery close together and counter-shafts thus short; diversity factor that permits the installa-

[1] From a discussion by H. R. Johnson, *Trans. A. I. E. E.*, Vol. 34, p. 757. Referred to also in the treatment of group driving, where the cases favorable to group drive are listed.

[2] As given in F. A. Halsey's handbook.

tion of less gross horsepower with a single group-drive motor than when several individual motors are used. (This case applies with special force to the smaller motors of say 2 hp. or less.)

(c) Constant-speed machines requiring excessive currents at certain points in the duty cycle and when, owing to such conditions, the gross horsepower rating of individual motors would necessarily be higher than the horsepower rating of a single group motor.

(d) Where a group of relatively very small machines is found and where the investment in a motor for each machine would be unduly high.

Under any of these conditions, however, the higher first cost of individual motors might easily be offset in a very short period if any considerable increase in production would result from their use in preference to a group motor. Furthermore, the first cost of individual-drive installations has often been increased in the past by the additional cost of mechanically attaching the motor to the machine. This objection is disappearing at the present time because of the growing tendency of the machine-tool manufacturers to design their machine tools so as to accommodate the motor. This feature is illustrated by Figs. 3, 4, 5 and 6, which refer to special designs of modern machine tools to which the motors may be effectively and readily attached.

FIGS. 3, 4 AND 5—LARGE RADIAL DRILL WITH ADJUSTABLE-SPEED-MOTOR DRIVE; SPECIAL ATTACHMENT FOR MOTOR WHERE BELT DRIVE IS EMPLOYED; LARGE MACHINE TOOL WITH MOTOR FORMING AN INTEGRAL PART THEREOF

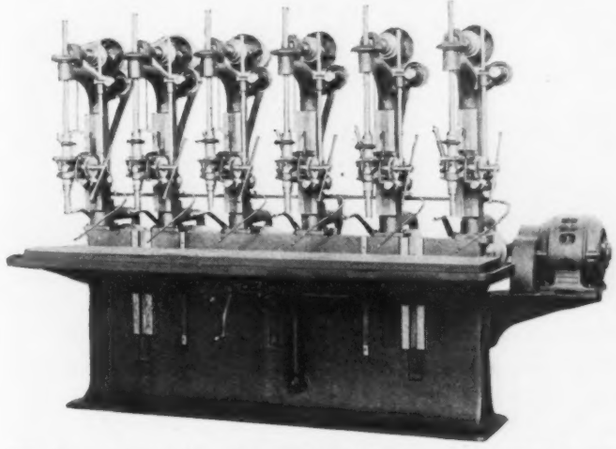


FIG. 6—SIX-SPINDLE HIGH-SPEED GANG DRILL EQUIPPED WITH MOTOR FOR INDIVIDUAL DRIVE

The fact that at least 50 per cent of the output of some of the larger machine-tool plants is now arranged for individual motor-driving is due partly, no doubt, to the increased demand of industrial plants for motor-driven machines, and also to some extent to the appreciation on the part of the machine-tool builders of the advantages of the motor-driven tool.

Turning now to some of these advantages of individual drive, it is important first to note how large a factor the reduced friction losses may be in the individual-motor problem. Figures gathered by A. G. Popcke for a typical case on which careful estimates were made for both methods of drive show that the increased first cost for individual motors may be offset in a relatively short time by the lower frictional losses brought about by their use.[1]

In a case of group drive the total first cost per floor amounted to $8,700, proportioned as follows: For the main shaft, 27 per cent; counter-shafts and pulleys, 57 per cent; group motor, 5 per cent. The losses due to friction with the group system were estimated at $2,500 per annum.

TABLE I—FRICTIONAL LOSSES IN SHAFTING FOR VARIOUS TYPICAL SHOP DEPARTMENTS

Department	Per Cent of Total Transmitted Power	Department	Per Cent of Total Transmitted Power
Pattern making	17	Chucking	26
Grinding	21	Planing	26
Light drilling	23	Cutter making	27
Lathe	25	Heavy drilling	34
Milling	25	Jig and fixture making	37
Cam cutting	26	Cutting-off	43

The first cost of an individual-motor drive for this same floor was estimated at about $10,400 per floor, proportioned as follows: For the 136 motors, 83 per cent of the first cost of the driving system, and for wiring, etc., about 13 per cent. The losses due to friction in this case were estimated at $700 per annum. In this instance the extra first cost of the individual motors amounts to $1,700, whereas the saving in frictional or mechanical losses by the use of individual motors amounts to about $1,800. In such a case, therefore, the increased cost of the individual-motor system would pay for itself through reduced mechanical losses in approximately a year's time.

[1] A discussion of this problem by the author from a somewhat different angle may be found in the *American Machinist* of 1914, Vol. 41, No. 11, p. 445.

The foregoing case is not presented because of any special interest attached to such a general example, but merely for the purpose of showing that, without any regard to the major advantages of the individual motor, it may justify itself on a basis of power efficiency alone in some cases. However, the economy of the individual-motor driven machine rests largely on the increased production it makes possible and on certain other secondary advantages, rather than on savings in power.

PRINCIPAL ADVANTAGES OF THE INDIVIDUAL MOTOR

As is so often the case in a problem of this nature, the advantages of the individual-motor-driven machine may be classified into primary and secondary divisions. Under the former there may be placed the direct economies which result from reduced power consumption and from increased production for the same labor cost, and under the latter all those more or less secondary advantages which are of course important but less tangible, as typified, for example, by clearer overhead space due to the absence of belts, increased safety to the operator by the use of individual motors, and similar items.

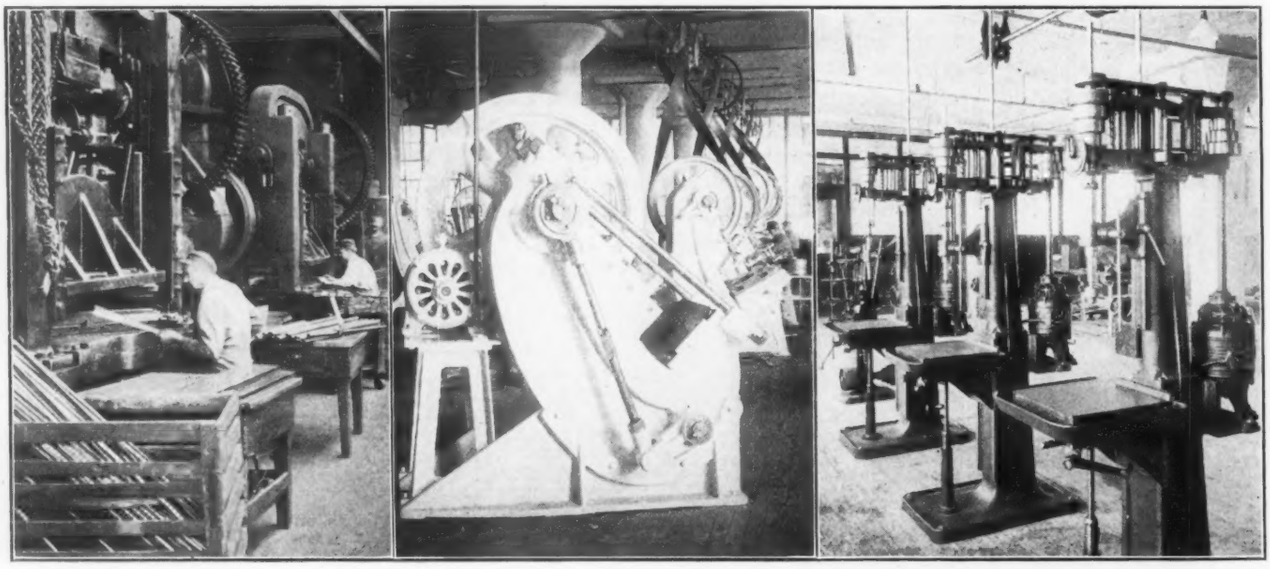
Under the principal advantages, then, are included power savings (already discussed) and increased production. The latter is brought about largely by cutting down the time required to perform some or all of the elements which constitute the cycle of the operation. Thus the cycle for a planer includes the time required for (a) the cutting stroke, (b) bringing the platen to rest, (c) reversing the platen, (d) the return stroke, and (e) again bringing the platen to rest and starting in on the cutting stroke. The analysis of the operation of such a machine is largely one of studying how each of the components of the cycle may be affected by the individual motor in comparison with the counter-shaft or group drive, keeping in mind that a 20 or 40 per cent saving in the time required for such a cycle means (according to Fig. 1) a corresponding percentage saving in the total cost of production. Obviously, any appreciable saving in the total cost of production by a given machine tool will be an item of great importance to the efficiency of the plant and will be of a magnitude which is far greater than any corresponding percentage saving in the power consumption of the same machine.

Many other advantages for the individual-motor drive might be added, but they were covered rather thoroughly in the last installment of this series; hence only those points which contrast the group and individual-drive methods are summarized here in Table II.

TABLE II—COMPARATIVE FACTORS TO CONSIDER

GROUP DRIVE	INDIVIDUAL DRIVE
Constant friction loss in shafts and belting.	Friction loss in motor and machine when operating, only.
Control of speed limited by the number of cone pulley steps.	Control of speed limited only by the number of notches on the controller and by the gear ratios.
Reversing must be accomplished by a clutch or by crossed belts.	Reversing may be accomplished by the handle of a controller.
Difficulty in stopping the machine tool at any given point.	The machine tool can readily be stopped at any desired point.
Speed increments are usually large.	The speed increments may be made as small as desired.
The size of the cut is limited by belt slippage.	The size of the cut is limited only by the mechanical strength of the machine and by the motor torque.
Difficulty is experienced in locating causes of delay in the work.	Delays in the work may easily be detected by the use of the graphic meter.
Changes in the location of machinery difficulty because shafts are fixed in position.	An individually motor-driven machine may be moved readily to suit the convenience of production.

In conclusion it may be stated that the foregoing study into these two methods of factory driving has had for one of its principal objects a general survey of the items involved in each method. While it is generally conceded that the individual motor is best and the most economical for the larger machine tools, such as milling machines, which require from, say, 10 hp. to 75 hp. each, for large lathes and planers and other large machine tools, the problem is not so definite when smaller machines are concerned, and in cases of the latter class due weight must be given to the various factors which are involved in the application of power to the machine, and the decision arrived at must be based on these factors.



FIGS. 7, 8 AND 9—GROUP OF PUNCH PRESSES DRIVEN BY SLIP-RING MOTORS; GROUP AND INDIVIDUAL DRIVE CONTRASTED (MACHINE IN FOREGROUND INDIVIDUALLY DRIVEN); VERTICAL SQUIRREL-CAGE MOTORS RUN ADJUSTABLE-SPEED DRILL PRESSES

September Central Station Operations

Income Derived from the Sale of Electrical Energy Reached a Total for the United States of $36,200,000, While the Output Sold Amounted to 2,130,000,000 Kw.-Hr.

REPORTS to the ELECTRICAL WORLD from central stations representing 59 per cent of the generating capacity of the industry of the country indicate the following results from operation for September for the entire industry: Income from sale of energy only, $36,200,000; output sold, 2,130,000,000 kw.-hr. The increase over September, 1916, was 13.8 per cent in income and 13 per cent in output.

With the exception of the New England States, there was a general tendency throughout the country to show smaller percentages of increase over the corresponding months of the previous year than has been the case in the preceding months of the current year. On investi-

TABLE I—CENTRAL STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
Oct.	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec.	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
1917		1917	1916		1917	1916	
Jan.	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June	63	23,279,000	20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July	63	22,768,000	19,680,000	15.8	1,397,482,000	1,159,410,000	20.5
August	63	22,706,000	19,961,000	13.8	1,451,765,000	1,223,210,000	18.7
Sept.	59	21,383,000	18,769,000	13.8	1,253,891,000	1,111,329,000	13.0

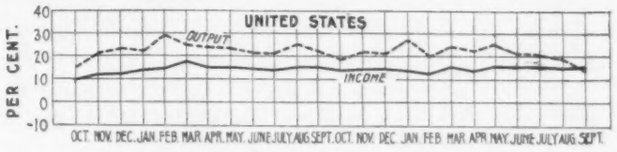
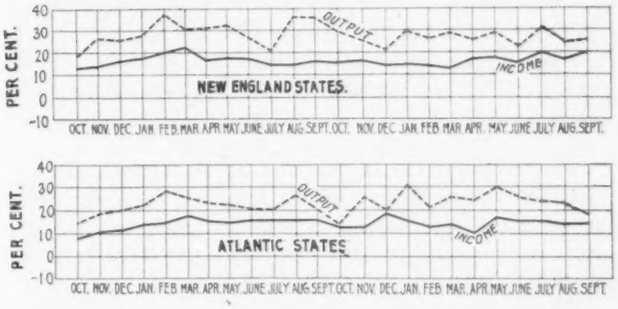

UNITED STATES
PER CENT.
OUTPUT
INCOME
OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY. JUNE. JULY. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY. JUNE. JULY. AUG. SEPT.

FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

TABLE II—CENTRAL STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States		Per Cent Increase	Percentage of Industry Represented	Atlantic States		Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded)		Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States		Per Cent Increase
			1916	1915			1916	1915			1916	1915			1916	1915	
INCOME	October	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
	November	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
	December	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5
	February	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
	March	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
	April	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	7.0	86	4,282,000	3,821,000	12.1
	May	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
	June	64	2,641,000	2,290,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
	July	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
	August	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	86	4,807,000	4,259,000	13.0
	September	56	2,379,000	1,980,000	20.1	61	8,215,000	7,191,000	14.3	48	6,430,000	5,489,000	17.1	81	4,316,000	4,070,000	5.9
KW.-HR. OUTPUT			1916	1915			1916	1915			1916	1915			1916	1915	
	October	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
	December	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
	February	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
	March	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
	April	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
	May	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
	June	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
	July	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
	August	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	86	413,299,000	381,190,000	8.0
	September	56	97,019,000	77,265,000	25.6	61	449,138,000	379,035,000	18.6	48	358,883,000	311,911,000	15.1	81	347,633,000	342,028,000	1.6

gation, however, it was noticed that this condition arose because of returns, not from a majority of the companies reporting, but rather from a few large properties where local conditions were unsatisfactory.

In this respect the most notable feature was the unsettled condition of labor. Labor disturbances being generally local, what affects one factory in a community frequently spreads through sympathetic strikes to other factories in that community, with the result of a very much curtailed local production. The effect on energy consumption is apparent. It was some such condition that was in a considerable measure at the bottom of the falling off in consumption for September. This is best brought out by the fact that the situation in the Western copper mines is virtually such a condition as is reflected in the Pacific and Mountain State percentages.

In addition, the release of a large number of men to the army caused a reduction in output of many industrial establishments. Some factories had a considerable percentage of their machines idle.

On the other hand, many central stations reported for September larger gains both in percentage and gross than ever before. With better rates for power in force in so many properties, the co-operative earnings, it will be noticed, held up well.

The accompanying curves show graphically the percentages of increase over corresponding months of the previous year as contained in Tables I and II.

WATER-POWER DEVELOPMENT IN NEW ENGLAND STATES

Henry I. Harriman Brings Out the Features of the Principal River Systems with Reference to the Fuel Problem and Cost of Energy

President Henry I. Harriman of the New England Power Company addressed the Boston Society of Civil Engineers recently upon New England water-power development, reviewing the characteristics of the principal river systems and touching briefly upon the features of the fuel conservation problem as influenced by the production of low-cost hydroelectric energy. Speaking of New England as a market for electrical energy, Mr. Harriman said that there are now more than 12,000 separate manufacturing establishments in this section of the country, and that whereas New England represents only 2 per cent of the United States in area and 4 per cent of its population, the value of its manufactured products is 10 per cent of the entire country's output. He predicted that as soon as financial conditions permit railroad electrification will be greatly extended. Few realize the importance of electrochemical power demands at present.

Mr. Harriman outlined the fundamentals of hydroelectric energy production from the economic standpoint (see ELECTRICAL WORLD, March 20, 1915, page 751, "Harriman on New England Water Power"), and emphasized the low relative cost of labor in water utilization. In many industries labor costs represent 50 to 70 per cent of the total compared with 10 per cent in a hydroelectric system. The outlook is most promising for a central station load in New England of 1,000,000 hp., in view of the fact that the manufacturer's money yields a higher return if placed in the productive side of his business instead of in the private power plant.

Normal costs, say those prevailing early in 1914, indicate that in general the initial outlay for a hydroelectric development will approximate double that for an equivalent steam plant. A fair range for the former is $100 to $150 and for the latter $50 to $75 per kilowatt. The water-power station, however, has distinct advantages on the side of lower depreciation and maintenance. Dams, station structures and water rights either do not depreciate perceptibly or else depreciate at a very low annual rate compared with boiler and steam-turbine equipment. Operating costs are extremely low in water-power stations, frequently reaching $0.0005 per kilowatt-hour, whereas with coal at the erstwhile figure of $4 per ton, an energy production cost of from 4 mills to 8 mills is common. In most successful hydroelectric stations the plant is so designed that it can utilize the twenty-four-hour flow of the river; that is, it is provided with dam and storage facilities sufficient to impound that flowage. It is far easier to start additional waterwheels than to place additional steam turbines in operation. Within the last few years about 250,000 hydroelectric horsepower has been utilized on New England streams. Notable achievements have also been accomplished in storage work, especially at the outlet of Moosehead Lake, Maine, where a dam has doubled the flow of the Kennebec River at Augusta. By the construction of the Somerset Reservoir of the New England Power Company on the upper Deerfield, in Vermont, 25,000,000 kw.-hr. is made available which otherwise would be wasted and river developments are stabilized which without the reservoir would be of little value.

Passing rapidly over the engineering features of various hydroelectric stations in New England, Mr. Harriman said that within the last eight years remarkable improvements have been attained in the design of waterwheels. When the pioneer Connecticut River plant was built at Vernon, Vt., vertical units of relatively high speed were installed, together with auxiliary wheels to permit the use of flood water. If the plant were to be built to-day, large slow-speed single-runner wheels of higher efficiency would be provided, although the auxiliary runner plan would probably be retained, at least in principle, to enable the plant to operate through a very wide range of river flow. At this point on the river the flow ranges in a single year from a minimum of 1500 cu. ft. (42.4 cu. m.) to a maximum of 150,000 cu. ft. (4243 cu. m.) per second. By the use of motor-operated gates in the dam and flashboards carried to the unusual height of 10 ft. (3 m.), the river is turned to excellent account at this point between flowages of 2000 cu. ft. (56.5 cu. m.) and 25,000 cu. ft. (705 cu. m.) per second. The station contains eight units and is giving good service, although its design is far from present-day standards. The speaker paid a high tribute to the bold and efficient engineering shown in Pacific Coast water-power enterprises, and in closing referred appreciatively to the good service yielded by the single-frame flexible type of steel tower when connected by a tie cable of ½-in. (1.25-cm.) steel. Such towers will hold, even when all the conductors are cut, though normally the latter are useful in tying these structures together. Up to 66,000 volts, wooden-pole lines with wishbone arm construction are giving very good service in New England.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

POPPET-VALVE AND UNIFLOW ENGINES' DIFFERENT FIELDS

Former Principally for Non-Condensing Conditions and Latter for Condensing Operation with Fluctuating Loads.

Some misunderstanding still exists regarding the difference between poppet-valve engines and uniflow engines as to both construction and use.

The poppet-valve engine has lift valves like those of a gas engine and is usually understood to mean a four-valve engine—that is, one with two steam inlet and two exhaust valves—whereas the uniflow exhausts through cylinder ports uncovered by the piston. In developing the poppet-valve engine the passages in the head have been so arranged that efficient jacketing is obtained, as well as elimination of leakage and wire-drawing losses in the valves and ports. Efficiency ratios of between 75 and 80 per cent of the Rankine cycle are obtained under non-condensing conditions with ordinary mill or power plant loads.

The uniflow engine is primarily adapted to loads of widely fluctuating nature and to condensing operation, for example, rolling-mill drive. The latter type is not recommended by one large manufacturer of both types of engines for condensing conditions or ordinary loads.

SPECIAL BEND DESIGNED FOR UNDERGROUND LAMP LATERALS

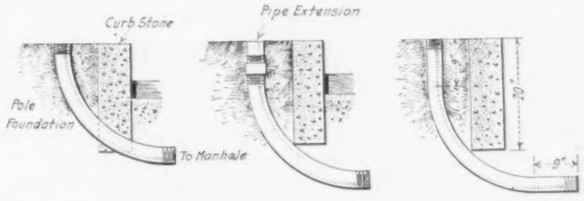
Construction Which Can Be Employed with Good Effect in Cases Where Cutting Away of Curbing Is Objectionable

BY C. W. CULLINAN

In supplying electricity for street lighting along public highways it has usually been the practice where underground service is employed to run lead-covered cables from the manhole through a 2.5-in. (6.3-cm.) lateral pipe to the lamp-post base. Where there is a concrete foundation under the pole many companies have used a standard pipe bend having an 18-in. (91.4-cm.) radius at the end of the horizontal lateral. In order to have the end of the pipe flush or a little above the top of the foundation, it was necessary to cut away the curb as shown in Fig. 1a. This practice weakens the curb and is rather costly, since the work of cutting away the curb requires the time of two laborers for approximately two or three hours. In addition, there is the possibility of breaking the curbstone.

Cutting away of the curbing became so general that a number of cities prohibited the practice when the new 20-in. (50.8-cm.) curbing set on a 6-in. (15.2-cm.) concrete base was adopted. One method which has been tried to avoid this objectionable construction was to attach a 7-in. (17.8-cm.) extension to the bend by a coupling at the upper end, lengthening it to reach up through the foundation as shown in Fig. 1b. This method was very expensive, as a threaded end was cut from each length of pipe and the remainder had to be returned to the storeroom for re-threading, or if it was retained on the job for use in straight lateral work, a sleeve had to be used to join the various unthreaded lengths.

To overcome these difficulties, it was decided to use a special bend as shown in Fig. 1c. This bend was of the standard 18-in. (45.7-cm.) radius but had a 9-in. (22.9-cm.) extension at each end. The bend gives ample clearance in passing under curbstones, and in many cases it is unnecessary to disturb the concrete foundation upon which the curb rests. The cost of supplying service has been materially reduced per lamp, and much time and labor have been saved. This bend is not limited to lamp laterals, but may be used in supplying service to buildings.



FIGS. 1A, 1B AND 1C—LAMP-BASE CONDUIT CONNECTION REQUIRING CUTTING OF CURB; ONE WITH EXTENSION THAT OBVIATES CUTTING CURB, AND ANOTHER WITHOUT DISADVANTAGES OF FIGS. 1A AND 1B

EFFECTS OF HIGH-PRESSURE TEST UPON RUBBER GLOVES

Current Through Gloves Limited to 10 Miliamp.—Results of Test Indicate that This Method Has No Harmful Effects on the Rubber

BY C. G. BROWN

Laboratory Director Rochester Railway & Light Company

All new gloves received by the Rochester (N. Y.) Railway & Light Company are tested before they are placed in service and in addition receive occasional tests afterward. The test is different from the ordinary one in that 10,000 volts is applied while an ammeter is connected in series with the glove so that the current passing through the glove can be observed. Tentatively, all gloves are considered unsatisfactory if the current exceeds 10 milliamp.

One objection which has sometimes been raised to this test is that the glove might be weakened thereby, especially if the test is conducted frequently. To determine whether there was any ground for this objection, an ordinary glove which had been used considerably was subjected to 10,000 volts for twenty-six hours, at the end of which time it broke down at the surface of the water. As an effect was noticed just above the point of breakdown, which appeared to have been

caused by corona, it seems probable that a brush discharge had been given off at this one point and that it was the gradual weakening effect of the brush discharge rather than the high tension applied to the glove which caused the breakdown.

Following this test, the glove was returned to the water without being immersed quite so far and subjected to a similar test for 118 hours before it broke down the second time. The second failure started a fire in the upper part of the glove, so that it was impossible to examine it to see whether there were any small cracks in the glove or not.

When it is realized that the part of the glove which is above water in this test is not a part which needs careful testing—in fact, if it is weakened there is no special damage done—and when it is considered further that the tests are not liable to be applied more than one minute or one and a half minutes a month, it should be evident that this method of testing is harmless, even if the experiments do not prove it.

RAPID DEVELOPMENT CAUSES HIGH RATE OF OBSOLESCENCE

Modern Equipment with Higher Economy Justifies Scrapping of Less Efficient Apparatus in St. Louis Stations

The effect which rapid development in power plant apparatus has had on the rate of obsolescence is very vividly illustrated by the radical changes which have been made in the stations of the Union Electric Light & Power Company of St. Louis in the last few years.

In 1904 the Lewis Street station had two 500-kw. turbines with a steam rate of 25 lb. (11.3 kg.) per kilowatt-hour, and the Ashley Street station contained two 2000-kw. vertical turbines with a water rate of 23 lb. (10.4 kg.) per kilowatt-hour. Later there were installed in the latter station four 5000-kw. turbines with a water rate of 20.5 lb. (9.3 kg.) per kilowatt-hour. After that came four 12,000-kw. turbines with a water rate of 16.4 lb. (7.5 kg.) per kilowatt-hour, and the new 20,000-kw. unit recently installed has a water rate of 11 lb. (4.98 kg.) per kilowatt-hour, or about one-half that of the 5000-kw. units installed in 1904.

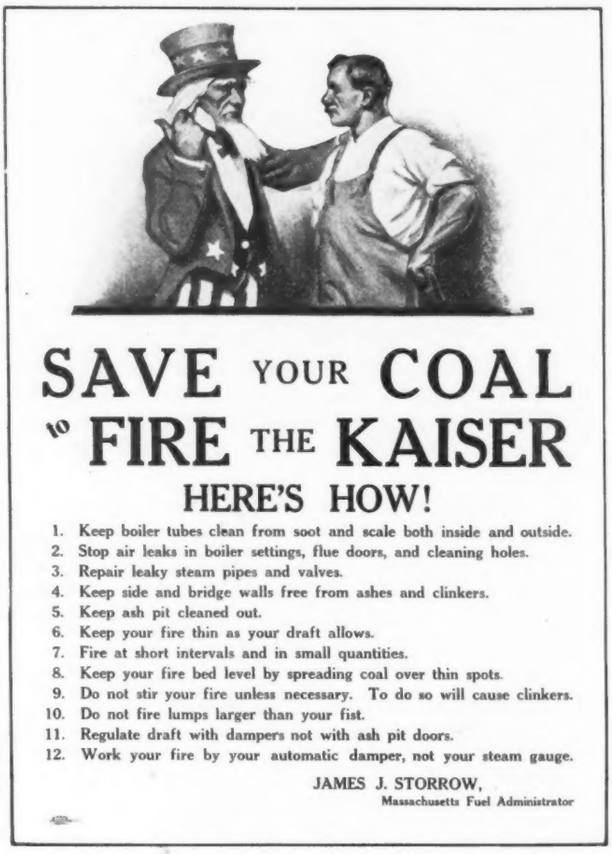
Equally remarkable has been the development in boiler equipment. With the original Scotch marine boilers 55 per cent efficiency at barely rated load was the best performance that could be realized. The Edge Moor boilers with chain grates, under normal operating conditions, had about 63 per cent efficiency with a rating of 125 per cent. The new boiler installation is guaranteed for 80 per cent efficiency, and the maximum capacity obtained in the last few months is about 300 per cent of rating, or 1700 hp. out of a 558 hp. boiler.

In 1905, with the completion of the first 12,000-kw. installation, the cost was $250 per kilowatt installed. In 1915, when the capacity had reached 68,000 kw., the cost of the development had been reduced to $108.70 per kilowatt installed. In 1918, with the complete development of the station to 116,000 kw., the cost will be $71.20 per kilowatt installed. The values quoted do not include investment in land. The last unit cost, being much less than a new station could be built for at this time, indicates why the company installed new equipment in the Ashley Street station.

FIGHTING THE KAISER IN THE BOILER ROOM

Twelve Time-Tried Methods of Improving the Boiler-Room Economy Suggested in Poster by Massachusetts Fuel Administrator

How each central station fireman can do his bit in his own plant toward winning the war against the imperial German government is indicated by the accompanying poster reproduction. The bulletin was issued for power and boiler plants by the Massachusetts Fuel Administrator, James J. Storrow of Boston, and shows


SAVE YOUR COAL
TO FIRE THE KAISER
HERE'S HOW!
1. Keep boiler tubes clean from soot and scale both inside and outside.
2. Stop air leaks in boiler settings, flue doors, and cleaning holes.
3. Repair leaky steam pipes and valves.
4. Keep side and bridge walls free from ashes and clinkers.
5. Keep ash pit cleaned out.
6. Keep your fire thin as your draft allows.
7. Fire at short intervals and in small quantities.
8. Keep your fire bed level by spreading coal over thin spots.
9. Do not stir your fire unless necessary. To do so will cause clinkers.
10. Do not fire lumps larger than your fist.
11. Regulate draft with dampers not with ash pit doors.
12. Work your fire by your automatic damper, not your steam gauge.
JAMES J. STORROW,
Massachusetts Fuel Administrator

in a dozen terse, practical lines of instruction how fuel can be saved to the disadvantage of the enemy and consequently to the advantage of Uncle Sam.

BELT TIGHTENER FOR PORTABLE MACHINES

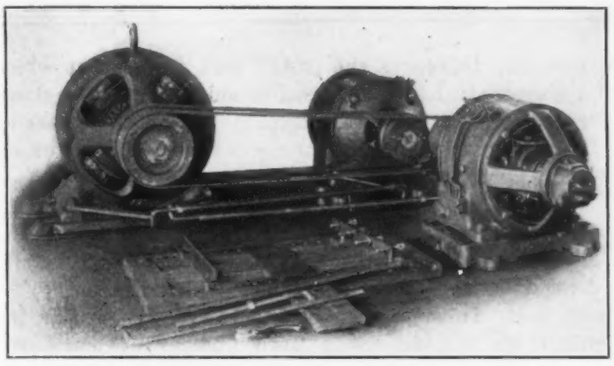
Consists of an Adjustable Strut Which Overcomes Tendency of Machine to Rotate Around a Vertical Axis

BY F. W. SPRINGER

Shown in the accompanying illustration is an arrangement that has been used in the laboratory of the University of Minnesota where portable machines must be held in a fixed relation to each other so that they may be connected by belts. The device is simple, inexpensive, and no doubt could be applied to advantage in various ways in other laboratories and industrial plants using motors. The belt tightener consists of an adjustable strut attached to the two machines to be belted together in such a manner that a restraining force is

applied just below the middle of the pulley on each machine, thereby preventing the tendency of the machines to rotate around a vertical axis. Hence the friction of an oiled floor is sufficient to hold the machines in line when running under full load.

As shown, the tightener is constructed of a piece of gas pipe drilled at 6-in. (15.2-cm.) intervals to receive a



TEMPORARY INSTALLATION MADE POSSIBLE BY RIGID SPACERS BETWEEN MOTORS

pin such as a large spike. Telescoping into the pipe are two rods, the positions of which may be adjusted relatively to each other by shifting the pin mentioned and the nuts on the ends of the rod. The ends of the rod are bent at right angles for insertion into suitable receptacles placed below the middle of each pulley. Usually a V-shaped bracket with a hole in the bottom of the V is attached to the machine. In some cases the hole may be drilled vertically or horizontally in the base in case it extends under the pulley.

In the foreground of the illustration is shown a floor frame upon which a machine may be mounted and fastened for applying the belt tightener. In case of excessive vibration, as in the use of a gas engine belted to generators, it might be necessary to use a U-shaped bracket.

MOTOR BEARINGS SHOULD RECEIVE MORE ATTENTION

The Practice of Feeling the Bearings so Common with Steam-Engine Attendants Could Be Followed to Advantage with Motors

It is to be regretted that electric motor maintainers do not acquire the habit of feeling the bearings of motors and of their dependent machines when making the wiping-off rounds. If they did, much expensive trouble would be avoided. The following experience illustrates what the proverbial "ounce of prevention" might have done in the way of saving a pound of cure.

A freight elevator the electric equipment of which, though very old, had given years of satisfactory service began to blow fuses with such frequency as to become a nuisance. The motor and the control apparatus had been "gone over" several times and the commutator of the motor had been turned because sparking had roughened it. In the meanwhile the 25-amp. fuses had been replaced with 50-amp. fuses, which, while not to be commended, gave relief for a few days, then the outfit refused to do anything but blow fuses.

An elevator man was sent for who disconnected the motor, tested it and found it in proper condition. Then with a bar he tried to turn the gears that the motor pinion had engaged, but could not do so. Inspection then disclosed that two bearings not far from the motor had "frozen fast."

MOVING HEAVY EQUIPMENT INTO UNDERGROUND SUBSTATIONS

Method of Lowering Rotary Converter and Auxiliary Apparatus Into Sub-Basement, with Some Necessary Considerations

Recently a Middle West company had to move two 4000-kw. rotary converters and the accompanying apparatus into two of its sub-basement type substations. As each rotary weighed 196,500 lb. (89,140 kg.) and the transformers 56,500 lb. (25,627 kg.), special arrangements had to be made for hauling these heavy and bulky pieces of apparatus through the city streets, taking them off the truck and lowering them through narrow spaces to sub-basements 15 ft. to 30 ft. (4.5 m. to 7.9 m.) below. The clearances, both horizontal and vertical, were very small and sharp turns some times allowed only 1 in. (2.54 cm.) clearance. The apparatus was handled as shown in the accompanying illustration. Owing to the great weight of the equipment, special attention had to be given to the location of the frame used in lowering the apparatus, so that the permissible bearing pressure upon the side walls, street or foundation upon which they rested would not be exceeded, whether or not the passageways permitted the apparatus to be lowered without crates and the space in the sub-

MOVING ROTARY CONVERTER FROM TRUCK INTO BASEMENT

station permitted unpacking. Where apparatus must be turned around it can usually be done more easily in the air. As there was not a direct passage from the street to the sub-basement in one case, a turn intervening, the apparatus was let down to the turn, moved around the corner and let down another 15 ft. (4.5 m.). Each job was completed in about thirty-six hours.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

JOINT BILLS FOR GAS AND ELECTRIC SERVICE

Economies in Various Directions Prompt Combination Companies to Discontinue Separate Billings to Customers in the Two Branches

Some combination companies supplying both gas and electric service are now recognizing their ability to economize on billing and mailing expense through joint bills for both services. Thus a customer using from one company both gas and electricity will have only one bill, on which will be his account for both services. The saving is, of course, apparent, and its effect on collections and on bookkeeping are to be considered. The customer receiving one bill instead of two at different times is not faced with the annoyance of the double service. Besides, with one customer account the necessity of going over his account twice is eliminated.

One of the latest companies to take this step is the Springfield (Ill.) Gas & Electric Company, which will render joint bills commencing Jan. 1, 1918.

Another interesting case of this character occurred recently in Atlanta, Ga. The Georgia Railway & Power Company supplies electric energy to the city, while a subsidiary (a separate company), the Atlanta Gas Company, furnishes the gas service. Customers using both commodities now receive but one bill. While this scheme has not been in effect very long, the results so far obtained, it is understood, have been satisfactory from the standpoint of all concerned.

METHODS OF CHARGING FOR ENERGY TO STEEL MILLS

Minimum Rate Cannot Be Obtained Without Taking Both the Power Factor and the Load Factor Into Consideration

Some figures presented by the central station power committee of the Association of Iron and Steel Electrical Engineers at its Chicago Convention, on the average rate offered by twenty companies furnishing power to steel mills, are given below:

	Rate (Cents per Hour)		
Demand (Kw.)	Maximum	Minimum	Average
1,000	1.246	0.700	0.9147
5,000	1.060	0.667	0.8464

The power factor, when specified, varied from 60 to 90 per cent. The average rate for mills having the power factor specified in their service contracts was lower than that for mills where the power factor is ignored. However, the minimum rate cannot be obtained without taking both the power factor and the load factor into consideration.

In some contracts the power paid for is that which is delivered to the high-tension side of the transformers. In others the power paid for is that which is delivered at the low-tension side of the step-down transformers, the power company paying the losses of the first transformation, the purchaser paying for all others.

Several methods are followed for charging the cost of the power to the steel mills, and the design of the electrical equipment of a steel mill must necessarily depend on the conditions under which the energy is obtained. In some cases payments are reckoned on the maximum demand for a fixed number of hours per month at a given price, and the remainder of the power is paid at a flat rate per unit. If, however, the power used during the working hours was reduced to the average, energy would be charged for at a lower rate which would materially reduce the amount of the monthly bill.

In other cases, when a large number of motors working at intermittent loads in several plants are getting the energy from the same supply, an equalizing effect of the power demand of all the motors at any time can be expected to take place, and the supply authorities can afford to sell energy to the steel-mill operators at a flat rate. Sometimes a flat rate is applied whenever the duration of the peak loads does not extend over a given period of time. On the other hand, when the peak loads last several minutes a different tariff is applied.

KEEPING THE POWER LOAD OFF THE PEAK

Seattle Company Has Secured the Co-operation of Large Consumers in Conserving Station Capacity by Changing Diversity

The Puget Sound Traction, Light & Power Company every year faces the problem of a daily peak which recurs every day for about a month in the latter part of the year and exceeds all other peaks by so much that it becomes the governing factor in determining capacities of generating stations.

This year the problem has become unusually acute because new industries, engendered by the remarkable growth of steel and wood shipbuilding in Seattle and the Puget Sound district, have absorbed the greater part of the surplus power, and plants, such as foundries, machine shops, engine and boiler factories and the steel plants that before the war operated only one shift, working eight hours and shutting down about 4.30 p. m., now operate two, and in some instances three, shifts in order to turn out ships for Uncle Sam. The demands of these plants when under one shift operation did not affect the peak, but the introduction of the second shift has made them a factor to be reckoned with.

Accordingly Sales Manager H. J. Gille has made a

study of how to relieve peak conditions, and the salesmen have undertaken to interview all power consumers using over 50 hp. in an endeavor to secure their co-operation in smoothing out the load curve during the critical month.

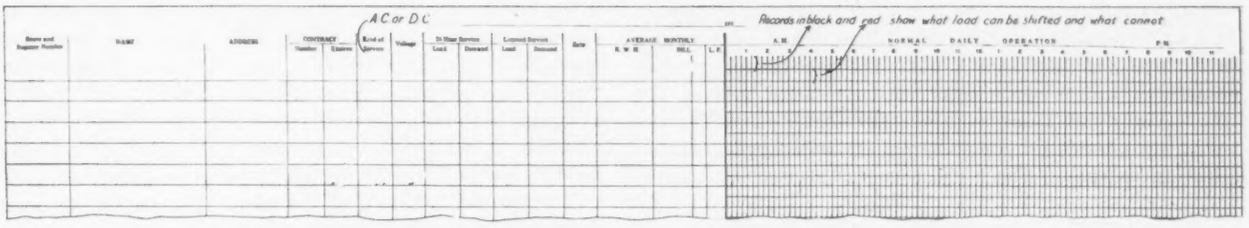
The peaks during this period establish themselves, and the load comes on and approaches its maximum with remarkable regularity. The hours of 4.30 and 7 p. m. mark the limits of the critical interval. The peak is caused by the overlapping of the lighting and industrial power loads on the electric railway evening rush-hour demand. The reason assigned for this overlapping just at this time is that, owing to the number of cloudy days and the consequent shortening of the daylight period, the commercial and residence lighting consumers turn on their lights before the one-shift power load goes off. Power consumers also use lights in their plants which at other times in the year they would not require. The street railway evening rush is the same throughout the year and reaches its maximum at about 5.30 p. m. This peak load cannot be shifted, nor can the residence and commercial lighting loads be limited.

Calls on power users, however, produced prompt response. Out of the first 266 consumers visited, only two were not able to co-operate to the extent of shifting their load a little. By arranging an earlier closing hour with some twenty-four consumers 2600 kw. was taken off the peak. By consultation with other large wholesale mercantile and manufacturing concerns having large numbers of employees plans were worked out whereby, instead of all the employees leaving the plants at the same time, different portions of them went off shift at half-hour intervals. This scheme, in addition to relieving street car congestion, assisted in smoothing out the street railway power curve as well as the industrial load curve.

Having thus eliminated the more readily recognized overlapping, a systematic study was begun to find just what changes would be most advantageous. Each power consumer's load with its characteristics was plotted and listed on a large sheet to facilitate careful comparison. Preliminary examination of this collection of data indicates that it may be more desirable to allow certain power users having unrestricted service contracts to operate on the peak than to ask them to shut down just before that time, because the large number of factory employees who use the street cars may make an increase in the street railway load greater than the factory load cut off.

By asking certain consumers to shut off a part of their load a few minutes early, and by asking certain others who could just as well do so to shut down entirely a half hour or an hour earlier, it is believed that the desired peak conditions can be obtained. This, of course, does not include plants connected with the shipbuilding industry. It is planned always to give consumers at least twenty-four hours' notice on a new schedule of working hours which it is desired to have them observe, thus affording leeway for arranging with workmen.

Another reason which contributes to this effort to obtain conservation and maximum use of generating capacity is the situation that central stations all over the country are facing, namely, the inability to obtain additional generating apparatus until after the war is over, so that the necessity of using the present equipment to the best possible advantage is only too apparent.



LOAD SHEET USED BY PUGET SOUND TRACTION, LIGHT & POWER COMPANY

The load sheet here reproduced lists, besides the power customer's name and address, the following information regarding the service: Data regarding contract; whether the service is on alternating or direct current and whether one, two or three phase; the voltage; the load and demand on twenty-four-hour service and also on limited service; the rate; the average monthly consumption, bill and load factor, and a normal daily load curve in black showing old conditions and in red showing new conditions of changed peak.

SMALL-TOWN COMMERCIAL PRACTICE AND RESULTS

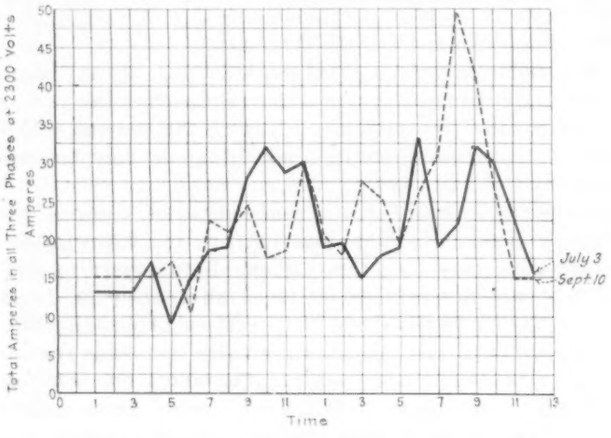
Data on Development of Service—Town of 1000 Where in Less than Two Years After Construction of Plant Additional Units Had to Be Provided

The extent to which electrical development may be carried in towns of less than 1000 population is a question to which time has yet to give a complete answer. Occasionally, however, data come to light which seem to indicate that the opportunities in these small communities are not so mean as they may appear to the casual estimator. An example of such data is given in the accompanying article. The town in question is Laurel, Neb., which has a population of 800. It lies in the northeast corner of the State, about 40 miles (64.37 km.) directly west of Sioux City, Iowa. It was too far removed from a large community to get transmission-line service and has put in a municipally owned electric plant consisting of a 70-hp. De La Vergne and an 80-hp. Giant oil engine each driving a three-phase, 60-cycle, 2300-volt alternator. Service was delivered for the first time on April 18, 1916.

The distribution system consists of a three-phase, 2200-volt primary system serving a 220-110-volt three-wire secondary. The primary lines are built of No. 6 TB-WP copper, and the secondary lines are of No. 4 TB-WP copper wire and No. 6 TB-WP copper wire. The distribution system is laid out so that there is one

transformer for every four blocks served, the transformer being placed at the street intersection which marks the center of the four blocks. Electric range customers are served by a three-wire tap consisting of either two No. 6 stranded wires and one No. 8 wire or two No. 4 and one No. 6, depending on the location of the customer with reference to the ilne. The street-lighting system is of the 6.6-amp. incandescent series type.

L. C. Walling, who is superintendent of the city's electrical department, has had charge of the construction and operation of the plant since it has been placed in service and has kept a complete record not only of customers but of each electrical appliance sold in the city. The plant at present has 227 meters and has the following connected load in motors and appliances in addition to the lighting equipment: 28 motors aggregating 97.5 hp., 112 electric irons, 6 percolators, 39 toasters, 16 vacuum cleaners, 41 electric washing machines, 14 air heaters, 6 electric water heaters, 4 curling iron heaters, 52 electric fans, 4 electric soldering irons, 27 electric ranges. The motors range in size from ½ hp. to 15 hp., there being one 15-hp. and nine 5-hp. units. This power load is carried on a separate three-phase, 220-volt circuit so that it will not interfere with the regulation of the circuits belonging to the lighting system.



LOAD CURVES, SHOWING EFFECT OF RANGE LOAD

An idea of the character of the plant load with these devices in service can be gained from the load curve shown herewith. One curve was taken on July 3, 1917, and the other on Sept. 10, 1917. The effect of operating the street-lighting system on an all-night schedule may be observed in the steady characteristics of the curve in the early hours of the morning. The effect of the cooking load which comes on heavy in the forenoon, owing to the fact that the principal meal of the day is at noon, may be observed between 9 and 12 o'clock on the curve. Again in the late afternoon the effect of the combination range and lighting load may be observed. The readings on the curve, which are given in amperes, represent the aggregate of the current values in the three phases of the 2300-volt, three-phase generator, it being impossible to secure kilowatt-readings owing to the fact that the plant has not a complete complement of instruments. A more accurate idea of the output from the plant may perhaps be gained from the fact that a total of the readings taken from customers' meters during the last five months was: May, 6391 kw.-hr.; June, 6204 kw.-hr.; July, 7084 kw.-hr.; August, 7065 kw.-hr.; September, 8174 kw.-hr. This does not represent the output of the plant because it does not include distribution losses or energy used for street lamps, of which there are twenty-four 100-cp., twelve 400-cp. and nine 600-cp., all of the 6.6-amp. incandescent series type.

The cost of the distribution line and the power house, including the first unit, amounted to $15,000. The later addition of the 80-hp. unit cost $4,041, making the total cost of the plant $19,041. The collections for the sale of electrical energy, including street lamps for the last six months, have averaged $774.52 per month, or about 9.1 cents per kilowatt-hour sold. The average monthly operating account over the same period was $455.32 per month, or 5.4 cents per kilowatt-hour sold.

Throughout the life of the plant the rates have been as follows: Light, 15 cents for the first 20 kw.-hr., 10 cents for all in excess of that amount; power, 7 cents for the first 100 kw.-hr., 5 cents for all additional; heating, 2 cents per kilowatt-hour straight.

According to Mr. Walling, the building up of the plant's present load is the result of a great deal of patient and painstaking sales effort. When the plant started operation in April, 1916, there were fifty-four meters connected to the lines. The fact that the City Council did not expect much more business than this is evident from the fact that the first unit purchased was rated at only 37.5 kw., which rating it was believed would be as much as the town would require for ten years. Nevertheless, by the first of August this unit was so well loaded that it was necessary for the city to go without street lighting on account of the power shortage which existed.

No small part of the commercial growth may be attributed to the fact that Mr. Walling established a free trial proposition on electric ranges, agreeing to install a range and permit the customer to use it for thirty days and then to remove it without cost if it proved unsatisfactory. All of the twenty-seven stoves which have been sold on this plan have stayed sold. Mr. Walling personally reads all meters and in this way gets in touch with each customer at least once a month. As he reads the meters Mr. Walling makes notes of customers' remarks as to what appliances they need or might use, and on his return to the office he places them on a mailing list to receive once a week manufacturers' bulletins telling about this particular device. By the time he gets around to that customer's premises a month later the customer is usually ripe for a sale. This accounts for the majority of appliances on the company's lines with the exception of the 112 flatirons. These were purchased by the city and are loaned to the customers who desire them as long as they continue in use.

Electromagnetic Hoist Saves Time and Labor

Under the above caption the ELECTRICAL WORLD published on page 913 in the issue for Nov. 10 an article descriptive of an electric hoist used in a Holyoke (Mass.) hydrant factory. It has since been brought to our attention that a Crocker-Wheeler motor is used on this hoist, and not a Sprague motor, as reported.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Commutation of Large Continuous-Current Generators and Rotary Converters Under Heavy Overload Conditions.—H. G. BELL.—The author describes a device enabling a continuous-current generator or rotary converter having commutating poles to be heavily overloaded without sparking. The commutating poles do not require to be carefully adjusted as in an ordinary machine, and on overload the commutating pole is automatically strengthened to the requisite extent.—London *Electrician*, Oct. 5, 1917.

Lamps and Lighting

Some Experiments on the Eye with Pendent Opaque Reflectors Differing in Lining, Dimensions and Design.—C. E. FEREE and GERTRUDE RAND.—The investigation of pendent reflectors is continued. Seven opaque reflectors differing in lining, dimensions and design are employed. In case of three of these reflectors modifications have been made to reduce the brilliancy of the opening. By means of one of these modifications a field of view was obtained presenting the lowest maximum of brilliancy that it has yet been able to obtain in an actual lighting situation. A marked characteristic of the effects produced by the dense and completely opaque reflectors was the low illumination of the ceiling and the upper part of the room and the high and in some cases almost glaring illumination of the floor and objects in the working plane. So far as effects on the eye of the kind registered are concerned, however, these irregularities of illumination and of the low surface brightnesses extraneous to the lamp and reflector seem to be of comparatively little consequence so long as the higher brilliancies of lamp and reflector are themselves properly taken care of. In this series of experiments including the translucent reflectors quite wide variations in the distribution of illumination were observed, ranging from well-illuminated ceilings and comparatively evenly illuminated walls and working plane for the reflectors of medium density to the dark ceilings and upper parts of the room and highly illuminated lower half of the room in case of the opaque reflectors. The greatest amount of light was noticed first in the upper half of the room, then in the lower, and within limits lanes of light have been produced.—Paper issued by the Illuminating Engineering Society.

Specification for Metal-Filament Glow Lamps.—This article summarizes the technical conditions proposed by the Swiss Union of Electricity Works relating to the sale of electric glow lamps. It includes specifications for metal-filament vacuum lamps and gas-filled metal-filament lamps and directions for measuring the candle-power of lamps.—London *Electrician*, Oct. 26, 1917.

The Visibility of Radiation.—PRENTICE REEVES.—A review of the early literature of this subject is given. The writer presents further data obtained by a method similar to that used by Nutting and Ives but by using different apparatus.—Paper issued by the Illuminating Engineering Society.

Generation, Transmission and Distribution

Effect of Storage Upon the Properties of Coal.—S. W. PARR.—From data collected by the author and presented in this paper it is concluded that bituminous coal can be stocked without appreciable loss of heat value, provided that the temperature is not allowed to rise above 180 deg. Fahr. In fact, there is no appreciable evolution of CO_2 temperatures below 260 deg. Fahr. The actual loss of heat value resulting from storage is small, the indicated loss being due more to an increase in weight of a unit mass of coal resulting from the absorption of oxygen than to an actual deterioration or loss in the heat unit. Freshly mined coal has a large capacity for absorbing oxygen, which combines chemically with both the organic combustibles and the iron pyrites. The combination of oxygen with coal at ordinary temperature generates a small increment of heat. The rapidity with which oxygen is absorbed depends upon the temperature of the mass and the extent of the superficial area exposed; that is, the fineness of division of the coal. If heat is generated by this slow process of oxidation more rapidly than it is lost by radiation, the acceleration of the reaction causes a rise in temperature which quickly brings the mass up to a dangerous point. A temperature of 180 deg. Fahr. is the danger point, for at this temperature practically all of the free moisture is vaporized and a further rise in temperature will be very rapid. Any method of storage to be successful must either check or prevent the absorption of oxygen to such an extent that the generation of heat shall not proceed so rapidly as to exceed natural heat losses due to radiation. Underwater storage prevents loss of heat value and is not accompanied by deterioration in physical properties such as slacking. Dry storage is far more safely undertaken if the fine material is screened out at the storage yard and the lumps carefully sized and stocked.—*University of Illinois Bulletin No. 97.*

Traction

Electrically Generated Steam for Locomotives as an Emergency Measure.—With coal at $16 per ton in Switzerland and scarce at that, and with a possibility of its reaching $20 in the near future, the railway authorities have been forced to consider plans for reducing coal consumption on the locomotives of the country. Water power is cheap, but electrification cannot be pushed rapidly on account of the cost and scarcity of materials needed for electric locomotives. One scheme considered is the use of electric heat under the boilers of the present steam locomotives. With electrical energy at 0.3 cent per kilowatt-hour and coal at $20 per ton, the electrically produced heat is said to be as economical

as that produced from coal, omitting the cost of fitting up the existing furnaces of the locomotives. This conclusion is based on the following data:

	Coal Consumption (Kg. per Ton-km.)	Steam Consumption (Kg. per Ton-km.) Saturated	Superheated
Rhaetische Railroad...	0.100	0.700	0.600
Gotthard Railroad.....	0.080	0.560	0.480
S. S. B. Kreise.....	0.075	0.525	0.450

The price of a complete installation for carrying current to the engines is figured at from 0.0086 cent per ton-kilometer (0.014 cent per ton-mile) to 0.011 cent per ton-kilometer (0.018 cent per ton-mile), while the rebuilding of present engines would cost 0.003 cent per ton-kilometer (0.0048 cent per ton-mile). While this temporary expedient would be justified only under extreme conditions, it may be the only solution of the Swiss transportation problem if the coal supply from Germany is shut off.—*Teknisk Tidskrift*, September, 1917.

New Split-Phase Locomotive of the Pennsylvania Railroad.—A. J. HALL.—The control equipment of this locomotive, which utilizes single-phase energy from an overhead trolley and transforms it into three-phase energy through the medium of a rotating type of phase converter to supply power to three-phase induction motors, is described in this article. Owing to the inherent characteristics of the induction motor no extra control equipment is required for regenerative braking.—*Electric Journal*, October, 1917.

Direct-Current Aluminum Lightning Arresters.—V. E. GOODWIN.—This type of arrester, it is pointed out, finds its principal application in the protection of street railway equipment. While it was not uncommon some years ago to find from 5 per cent to 10 per cent of a railway company's cars out of commission after a severe electrical storm, the table given shows that since the introduction of the direct-current lightning arrester only a very small percentage of motors protected by this device are damaged.—*General Electric Review*, November, 1917.

Installations, Systems and Appliances

Metal Cutting with the Electric Arc.—GRAHAM KEARNEY.—This article is based on observations made by the author and contains some recommendations respecting the best arrangements of electrode holder, size and shape of carbon, and methods of securing contact for the positive terminal to the material being worked on. A table is included which is an exact copy of notes taken in the course of an afternoon's work on 9/16-in. (14.3-mm.) steel plate. The records show that the cost per ton by the oxy-acetylene method was approximately $11 as compared with $2.40 for the electric arc method. Besides this economy, the author points out that the electric arc is much safer, for during the time that the oxy-acetylene apparatus was used two explosions of gas tanks occurred.—*General Electric Review*, November, 1917.

Electric Winding.—D. BURNS.—This paper is concerned with discussing the problem of electric shaft winding, and is illustrated by examples. It is pointed out that it is necessary to fix the following preliminary details in working out the problem: (1) the quantity of coal to be raised, the cage load, the number of winds per day or per hour, the time per wind with the average speed; (2) the strength, weight and size of the winding rope to be used; (3) the diameter of the drum and sheaves to be used; (4) the inertia, acceleration and retardation of the moving masses; (5) the determination of the speed, torque and power diagrams from the foregoing data, and (6) the determination of the horsepower of the motor from the torque diagram.—London *Electrician*, Oct. 12, 1917.

Construction of Large High-Tension Transformer Stations.—MAURICE KOECHLIN.—Interruptions to service due to defects in transformer stations might be made less numerous, in the author's opinion, were experience gained in one station put to use more generally in others and greater unification thus brought about. In studying this matter three principles should be kept in mind—security of service, rapidity of operation, and economy. A simple scheme, judicious choice and disposition of apparatus, sufficient space between busbars and machines and well-thought-out signals are requisites of security. Rapidity should be sought by uniting at one spot the control of all interrupters and measuring instruments. Economy may be obtained, not by diminishing the equipment, but by so arranging it as to reduce the space occupied by connections, and thus the dimensions of the station.—*Revue Gén. de l'Elec.*, Oct. 20, 1917.

Wires, Wiring and Conduits

Phantom-Circuit Remote-Control System.—H. H. REEVES.—The system dealt with in this article was designed to provide a simple, reliable and economical means for controlling groups of street incandescent lamps which are installed at a distance from the central station and are fed by local transformers. The author describes the theory and operation of the system and the various component pieces of apparatus, and analyzes the system's merits.—*General Electric Review*, November, 1917.

Electrophysics and Magnetism

Relations of Magnetism to Molecular Structure.—A. P. WILLS.—A brief discussion of the works of investigators like Langevin, Weiss, Barnett, Einstein and de Hass to point out how well each of their theories explains the relations between magnetism and molecular structure.—*Science*, Oct. 12, 1917.

Units, Measurements and Instruments

Squirrel-Cage Speed Indicator.—E. B. BROWN.—The indicator described in this article depends for its action upon the modification of the main field by the cross-magnetization of a rotating armature in a small generator.—London *Electrician*, Oct. 26, 1917.

An Approximate Method of Checking the Accuracy of a Direct-Reading Insulation Testing Set.—G. W. STUBBINGS.—The article suggests a method of checking the accuracy of direct-reading testing sets by using a moderately high resistance in series with an emf. opposed to that of the magneto-generator.—*Electrical Review*, Oct. 5, 1917.

Apparatus for Measuring Very Strong or Very Weak Alternating Currents, with Adjustable Field Magnet.—PESTARINI.—The arrangement described comprises a special galvanometer and a static phase transformer fed from an alternating auxiliary source. The galvanometer comprises two coils, one fixed and the other movable. If the current to be measured is weak, it is

passed through the moving coil and the phase transformer feeds the fixed coil. If the current to be measured is large, it is sent through the fixed coil and the moving coil is fed by the phase transformer. The theory of the apparatus is the same in both cases, and consequently the author takes up only the case for weak current.—London *Electrician*, Nov. 2, 1917.

High-Temperature Thermostat.—J. L. HAUGHTON and D. HANSON.—The object of this paper is to describe certain alterations which have been made in the apparatus to render it suitable for much higher temperatures. The instrument consists of a double-walled vessel, similar in shape to a Bunsen ice calorimeter, which is made into a furnace by winding it with nichrome wire. This vessel acts as a gas thermometer, and the variations in the pressure of the air contained in it are used to operate a contact breaker, which increases or decreases current supplied to the furnace, according as the temperatures fall below or rise above the desired value.—London *Electrician*, Oct. 9, 1917.

Telegraphy, Telephony and Signals

Telephone Interference from Induction.—E. W. KELLOGG.—The author takes up the general principles of circuit balance, method of checking circuits for mutual balance, the development of system for prevention of cross-talk, the balancing against foreign circuits, and reducing disturbing influences.—*Telephony*, Nov. 10, 1917.

Elimination of Radio Strays.—CORNELIUS J. DE GROOT.—Continuation of an article on an investigation under the auspices of the Dutch East India Department of Telegraphs. The article includes a classification of strays as to electrical nature and source, tests for the separation of different types of strays, and proof that the lightning type of strays is not the most general type and that the difference between day and night strays is not due to differences of absorption between the lightning center and the receiving station.—*Wireless World*, November, 1917.

Wave-Lengths of Antennas with Flywheel Coupling and a Second Approximation for the Time Period of a Wavemeter.—BALTH. VAN DER POL.—Assuming that the self-inductance and capacity of the vertical part of the aerial are equally distributed over the length of it, the author shows that the problem of finding the natural wave-lengths can be solved with the aid of elementary mathematics. As a result of this solution he shows some interesting peculiarities of the fundamental and higher harmonics of an antenna with flywheel coupling, peculiarities that are usually not considered in leading textbooks on wireless telegraphy. The solution is given in full in the article.—*Wireless World*, November, 1917.

The Duplex Balance.—JAMES FRASER.—The author discusses a method of balancing underground duplex circuits.—*Post Office Electrical Engineers' Journal*, October, 1917.

Miscellaneous

Mineral Resources of the United States.—This report, which is presented in two volumes and represents findings of the United States Geological Survey, covers metallic and non-metallic substances. Among subjects treated in this report that are of interest to the readers of the ELECTRICAL WORLD are fuel briquetting, asbestos, slate, graphite, mica, production of coal, distribution and consumption of coal, coke, petroleum and natural gas.—Bulletin issued by the United States Geological Survey, Department of the Interior, Washington, D. C.

Working Costs of the Principal Prime Movers.—OSWALD WANS.—Data are given that should be of service in estimating capital expenditures and working costs and in establishing the relative commercial values of the principal prime movers. For this purpose typical examples of the following prime movers are considered: Suction-gas engines and plants burning anthracite, coke and wood refuse; gas engines using town gas; oil engines of the solid-injection, high-compression type; Diesel engines, and steam engines. The scope of the paper includes units up to a working load of 500 brake-hp., a power range embracing the engines for which there is by far the greatest demand. The author divides the items constituting total working costs into two parts—capital charges and running charges. Under the first part are included depreciation, insurance and interest upon capital expenditure. Under the second part are included the cost of fuel, lubricating oil, water supply, sundry stores, labor and repairs.—London *Electrical Review*, Oct. 26, 1917.

High-Economy Oil Engine.—Recently there has been developed in Skien, Sweden, an internal-combustion engine which is said to use only 116.2 grams of fuel oil per horsepower-hour. As the best recorded performance of a Diesel-type engine heretofore has been about 170 grams per horsepower-hour, the new engine represents a considerable step in advance. Although detailed description of the construction is at present not available, it is stated that a compression of between 60 and 70 atmospheres is used, resulting in a temperature of nearly 500 deg. C.—*Teknisk Uteblad*, September, 1917.

The Future of Electricity in Russia.—This article, which supplements one on the present state of electrical distribution in the vast Russian territory, takes up the power resources of the new republic. Under combustibles are included peat deposits covering 35,000,000 hectares (93,000,000 acres) in European Russia exclusive of Finland, which has 7,400,000 hectares (1,828,000 acres) more. Russia is also rich in coal deposits, and petrol is employed in some regions for heating boilers. The product of the turf pits is estimated at 96,000,000,000 tons, or the equivalent of 48,000,000,000 tons of coal. Of coal itself it is estimated that Russia possesses 75,000,000,000 tons. The water power capable of development in Finland, the Ural and the Caucasus is estimated at 15,400,000 hp. Of this only 250,000 hp. was utilized in 1910, and since then development has not been rapid. While awaiting capital for hydroelectric exploitation, Russia has depended on coal, of which she imported annually, principally from England and Germany, before the war, from 7,000,000 tons to 8,000,000 tons, the factories of Petrograd, Libau, Riga and other places finding it cheaper to import their coal from Yorkshire and Cardiff than to haul it from the Russian mines. The future of Russia, concludes the writer, depends on the realization of great projects for transmitting electricity, and unless the industries of the country are to continue under German domination to a degree even greater than in the past, capital for their development must come from other countries—England or France, the United States or Japan.—*L'Industrie Elec.*, Oct. 10, 1917.

Book Reviews

ELECTRICAL MEASUREMENTS. By Frank A. Laws. New York: McGraw-Hill Book Company, Inc. 720 pages, 442 illustrations. Price, $5.

This is an excellent textbook on electrical measurements for the classroom and technical laboratory. The illustrations are abundant and excellently prepared. The diagrams of connections and vector relations are simple and easy to apprehend. The book has been prepared after long experience with the difficulties which students of electrical engineering encounter in their testing laboratory work. It embodies a large amount not only of compilation but also of individual effort and investigation. The chapters relate to the following topics: The measurement of current, the ballistic galvanometer, resistance devices, the measurement of resistance, the measurement of potential difference and electromotive force, power measurement, measurement of inductance and capacity, induction instruments, electricity meters, phase meters, curve-drawing meters, instrument transformers, the calibration of instruments, determination of wave form, cable testing, and legal definitions of the electrical units. A good index of subject matters concludes the book. The treatment is both descriptive and analytical. The mathematical demonstration is adapted to the acquirements of engineering students who are familiar with the fundamental principles of the direct-current and alternating-current circuits and who can employ the calculus. The book will be of value not only as a textbook for college students but also as a reference volume for all electrical engineers employing modern measuring apparatus.

THE RANGE OF ELECTRIC SEARCHLIGHT PROJECTORS. By Jean Rey. Translated by J. H. Johnson. New York: D. Van Nostrand Company. 152 pages, illustrated. Price, $4.50.

This account of searchlights and their practical properties is particularly to the point at the present moment, the more so as the data are from recent practical investigations conducted on modern types of searchlights actually used in war. It brings together the theory of the production and distribution of light in the searchlamp and the practical facts regarding the utilization of the flux generated in a concentrated beam for military purposes. Save for the recent papers of Professor Blondel, fortunately utilized in the preparation of this work, there has been very little exact information regarding the performance of the searchlight. One can approach the theory of the searchlight from many standpoints, the final and crucial questions being the total luminous flux of the source, the proportion of this which gets out of the searchlight in the direct beam, and the actual spread of this beam. As a matter of fact, for recent military searchlights the form has settled down into fairly definite proportions, so that the ratio of total to effective flux can be rather certainly reckoned with. Lamps and mirrors have settled toward standard design, and with the mirror and lamp determined the spread of beam is also settled within moderate limits. One can therefore arrive at certain useful generalizations regarding the result in illumination to be expected from the apparatus at hand. He can even, employing standard military forms, base the result on the energy in the arc. For instance, the table on page 60 of the book before us shows that one will not go far wrong if he counts on attaining at a distance of 1000 meters an illumination of 6.5 lux per kilowatt in the arc. Improvements in the theory and practice of the apparatus are in the direction of concentrating more energy into a smaller arc and hence obtaining more luminous flux and more precise focusing. Starting from the properties of the searchlamp, the author in the second part of the book takes up the problems which are of immediate importance in the practice of war, the amount of illumination necessary for distinguishing the objects customarily sought at various distances, the effect of varying conditions of atmosphere on these results, and the probable range of action of searchlights of various sizes. The information given on these points, and especially the data bearing on changes of visibility due to atmosphere, are exceedingly important, and their value to the artillery officer can scarcely be overestimated. The book will not be found particularly easy for the untechnical reader, but the charts and tables are of exceptional value, although their use is not always quite obvious without pretty careful study of the text. It would have been well had the translator taken the opportunity to set out the terminology employed in such plain terms, and in a position so accessible to tables and charts, that even a careless reader could not fail to interpret the data correctly. The volume is certainly a most timely one and should prove invaluable to students of artillery practice.

THE APPLICATION OF HYPERBOLIC FUNCTIONS TO ELECTRICAL ENGINEERING PROBLEMS. By A. E. Kennelly. New York: The McGraw-Hill Book Company, Inc. 302 pages, illustrated. Price, $2.50.

The first edition of this book, published five years ago, was based on a series of lectures which the author delivered before the University of London. This, the second edition, differs from the first only in that two new appendices have been added. Few books have been so fruitful in their results as this one on "The Application of Hyperbolic Functions to Electrical Engineering Problems." A working knowledge of these functions is now a necessary part of the equipment of those who would study problems in alternating-current transmission. The methods of the author have been freely used by other writers, and the accuracy of his results have been checked on the many artificial transmission lines that have recently been constructed. The book is not an elementary text on the subject, and those who have not a sound knowledge of algebra and of calculus are not likely to read beyond the first few pages. The bulk of the book is devoted to the application of hyperbolic functions to the solution of problems on alternating-current power lines and on wire telegraphy and telephony.

Books Received

PRACTICAL ELECTRIC ILLUMINATION. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 226 pages, 166 illustrations. Price, $2.

THE THEORY OF THE SUBMARINE TELEGRAPH AND TELEPHONE CABLE. By H. W. Malcolm. London, England: "The Electrician" Printing & Publishing Company, Ltd. 566 pages, 198 illustrations. Price, 18s.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRICAL DIVISION OF WAR INDUSTRIES BOARD

War Service Committee of Electrical Manufacturers Asked to Meet in Washington—War Problems and Government Needs

A bulletin issued by the electrical division of the War Industries Board of the Council of National Defense follows:

The war service committee has been asked to convene in Washington at the earliest convenient date for the purpose of discussing a number of problems, among them means of distributing in an equitable manner the needs of the government in lines which have been standardized by the Electric Power Club.

The government is in need of many devices for the manufacture of which electrical plants are entirely competent. It is, however, the policy not to request diversion to new classes of work so long as the needs for electrical equipment are unsatisfied. The proposed conference with the war service committee will undoubtedly develop whatever excess capacity there may be, if any, which can be diverted to the manufacture of mechanical parts for other requirements.

The Signal Corps needs small gasoline generating sets which can be readily transported on trucks. It may need additional searchlights. Those companies which have developed such direct-connected sets are requested to send a list of the sizes, accompanied by some general statement as to the delivery that could be made on each size.

The engineers, ordnance and others, and also private companies attempting to extend their plants for the manufacture of equipment needed are in turn in need of prime generating equipments, principally of the turbine type, the available supply being less than the immediate requirements. For the same departments deliveries are unsatisfactory for motors of 150-hp. capacity and larger. If the orders already placed and to be placed for the smaller sizes can be properly distributed so as to take advantage of the facilities of all companies, immediate needs in this respect, both for the government directly and indirectly for those who will supply the government, can be satisfactorily met.

The electrical division is fairly conversant with the limitations of the abilities as to sizes in the standard lines, but is not fully conversant with individual specialties that you may have developed. If you publish a stock bulletin and list thereon all of the specialties which you make and will indicate thereon something as to the delivery you are in a position to make as per former requests, that will be satisfactory. Please be sure that any type designations used in these lists are explained so that we can understand the exact nature of the apparatus listed. If you do not publish a stock bulletin, will you write us in general terms as to your delivery situation? It will not be necessary immediately to ask you to perform any unnecessary labor to prepare definite tabulations.

The functions of the electrical division may be in part described as follows:

First. A statistical department as to sources of supply for electrical apparatus. Electro-medical apparatus is handled entirely by the medical corps. Small electric tools, electric drills, etc., are handled by the small tool division. Wire is handled by the wire committee. Undoubtedly provision will shortly be made for handling of classes other than apparatus.

Second. Consulting engineers to all departments with a view to standardizing requisitions and preventing unnecessary hardships, which will in turn facilitate production.

Third. Assisting buying commissions of foreign governments both as to their inquiries and advising as to the desirability or acceptability of proposals which may be received.

Fourth. Canvassing the departments as to their future needs in general, with a view to advising the manufacturers that they may in turn somewhat anticipate and prepare for such requirements.

Fifth. Advising with private companies as to sources of supply for early delivery to enable them in turn to start their production at the earliest possible dates.

WAR SERVICE COMMITTEE OF MANUFACTURERS MEETS

Organization of Representatives of Associated Manufacturers, Electric Power Club and Electrical Manufacturers' Club

In accordance with the resolution of the Electrical Manufacturers' Council calling for an organization meeting of the war service committee of electrical manufacturers, the representatives of the different organizations assembled at the Bankers' Club, New York, on Nov. 28. In the unavoidable absence of D. H. Murphy, secretary of the Electrical Manufacturers' Council, the meeting was called by S. L. Nicholson, chairman of the council.

As stated in last week's issue of the ELECTRICAL WORLD, R. K. Sheppard, Simplex Wire & Cable Company, and J. R. McKee, General Electric Company, are the representatives of the Associated Manufacturers of Electrical Supplies on the war service committee thus outlined. C. A. Terry, Westinghouse Electric & Manufacturing Company, and W. W. Nichols, Allis-Chalmers Company, represent the Electrical Manufacturers' Club. C. L. Collens II and J. C. Hobart represent the Electric Power Club.

SECTION MEETINGS OF THE ASSOCIATED MANUFACTURERS

Molded or Formed Insulation Section, Insulating Materials Section and Line Material Section to Meet Next Week

The Molded or Formed Insulation Section of the Associated Manufacturers of Electrical Supplies will meet on Wednesday, Dec. 5, at 2 p. m., at the association offices, New York. A number of important matters are scheduled for consideration and an interesting meeting is anticipated.

The Line Material Section of the Associated Manufacturers of Electrical Supplies will meet on Tuesday, Dec. 4, at 2 p. m., at the association offices, New York.

The Insulating Materials Section will meet at 10 a. m. on Dec. 6 at the association offices, New York. Committees are to be appointed and other important work transacted.

NEW ENGLAND COMPANIES ARE UNEASY ABOUT FUEL OUTLOOK

With Estimated Shortage of 6,000,000 Tons During the Coming Winter, Curtailment Is Urged as Conservation Move

According to a report of the sub-committee on coal conservation of the Boston Chamber of Commerce, New England is likely to run about 6,000,000 tons short of its coal supply in the coming winter, and out of the reduced amount available must come all the coal needed to carry on the many war industries of that section. This condition will prevail, it is said, even with full use of the ocean-carrying facilities now at the disposal of the Northeastern seaboard States. Fuel Administrator J. J. Storrow of New England says that New England is already short of soft coal by several million tons, and that while the hard coal supply was reasonably satisfactory two months ago, not enough is coming forward now to meet the increased needs.

Every effort is being made by the Fuel Administrator to facilitate shipments and secure economical utilization of the coal received. Many relatively unnecessary uses have been curtailed or eliminated. The market for cordwood is most promising, and plans are under way to utilize the native supply of this fuel to a larger extent.

In the campaign for coal conservation, merchants are being urged to darken show windows or to reduce total wattage of lamps or hours of burning in each installation; to enlist co-operation of employees in turning off as many inside lamps as possible on sunny days; so far as possible to carry on work near windows which otherwise would require interior lamps for longer periods; to clean shop by day instead of during the evening; to dress certain windows by day when feasible; cut down idle use of lamps over desks in customers' rooms of banks, and to reduce hours of showcase illumination. Elevator service is being curtailed in many office buildings and substantial curtailment of electric signs continues under discussion.

Recent inquiries by the ELECTRICAL WORLD as to the coal situation among New England central stations indicate that at present the larger companies are in pretty good shape with respect to fuel on hand, and among these the situation has not yet reached an alarming stage. Among smaller and medium-sized companies there is more anxiety as to prospects of obtaining satisfactory deliveries during the next few months. It is felt that, in view of the large amount of munitions plant service on central station circuits and the recognized public necessity of street and even private lighting, central stations stand an excellent chance of being supplied preferentially when necessary. Some companies have been obliged to refuse lucrative power business on account of lack of capacity or uncertain fuel prospects; in others a vigorous and successful campaign against isolated plants is being made and business secured which might long have been withheld under normal conditions.

Within their capacity the large New England hydroelectric systems are performing service of utmost value in critical times. An official of one of the largest companies informed the ELECTRICAL WORLD that on account of the money market it will be impossible for the present to undertake comprehensive extensions of his hydroelectric system planned last spring, although energy is in great demand. According to the New England point of view here is a field for governmental co-operation, in view of the threatened power shortage due to the uncertain fuel situation this year and next.

PRICE-FIXING, TAXATION AND OUR WAR-TIME NEEDS

Report to the President and Congress by the Foreign Trade Council—"Production a Question of Profit"

A report to the President and Congress, made by the National Foreign Trade Council, of which James A. Farrell is chairman, discusses principles underlying the co-ordination of price-fixing, taxation and foreign trade. Among the points which it makes are:

It is a natural, economic law that whenever the government requires the total possible production of any article, whether for war or peace, it must pay such price for that article as will return a fair profit to the producer otherwise, and if that producer cannot secure a fair return or profit upon his labor and investment he will not labor or invest, and production is necessarily curtailed.

In the arbitrary fixing of prices by the government profits should be estimated upon the highest normal cost of production instead of upon some lower cost made possible by larger investment, broader experience, superior methods or any other cause tending to improve the efficiency of production.

Naturally this method will result in conferring the advantage of higher profits upon the concern producing most cheaply, but this advantage can be effectively neutralized by the application of an intelligent plan of profit taxation.

In an ideal plan for price fixing and profit taxing by the government high production and not low prices should be the controlling consideration. If the final determination of the war is to be measured to any considerable extent by the relative economic power of the belligerents—and, of course, it will be so measured—the existence of the things which money can buy will be of far greater importance than the possession of money itself. The undesirable effect of unreasonably high prices even would be only temporary, as, when the emergency arises, the government, through profit taxation, will be able to recover for war purposes the greater portion of the unduly high profits.

The practical separation of the question of production from that of profit is not possible. Production essentially is a question of profit. Without profit production ceases. The times when production occurs at a loss are incidental always either to temporarily adverse conditions or to the deliberate purpose of concerns, usually of great size, to undertake development work at an immediate loss for the purpose of ultimate profit. In any of these cases production is a matter of profit, a fundamental fact which the government must recognize in the performance of its duty of price fixing and taxation.

In considering the purposes of war we should not lose sight of the fact that in war, as in other things, there can be a class of economy which kills. A recent writer, speaking of the war, has said: "It does not matter to the gunner whether the shell which he is firing costs half as much or twice as much as it would have cost in 1913. What does matter is that he should have the shell."

Next after production, and scarcely less important in its bearing upon the purposes of war, comes conservation. This should not be confined to the elimination of luxuries and unnecessary things, nor to what might be referred to as conscious and intentional waste, but applies to every activity of the individual, the concern and the nation which in its operation uses men or materials in excess of what actually would be required in the production of satisfactory results, assuming proper methods.

We are not attempting to find fault with or criticise the government—we are desirous only of helping in every possible way to win this war, because if we do not win it it

will not matter particularly what else happens to us, and we firmly believe that it is only by careful and faithful application of sound fundamental economic principles that we can carry through successfully the enormous burden laid upon us.

Closer co-ordination of the government's buying activities is also recommended.

HASTENING MOVEMENT OF COAL CARS IN INDIANA

Improvement in Unloading Results from Careful Attention to Practices of Dealers—Providing for the Consumers

In relieving shortage of domestic coal in Indiana, the Federal Fuel Administration for Indiana has had occasion to attempt to hasten car movements and has tried to impress upon dealers that it is necessary to get cars unloaded quickly.

When information is received from operators that shipment has been made on one of the requests there is mailed to the dealer a double postal card with a sticker on it. Parts of these are indicated in the accompanying illustrations, together with another postal, which is sent if the return postal card shows that the dealer took more than thirty-six hours to unload.

The man in the trenches works overtime and Sundays. This country is short of coal cars. Help this country and get this car unloaded quickly no matter what hours you work.

Federal Fuel Administrator for Indiana

PART OF TELLING POSTAL CARD ISSUED BY THE INDIANA FUEL ADMINISTRATION

Alexander R. Holliday, Assistant Fuel Administrator for Indiana, is president of the Noblesville Heat, Light & Power Company and treasurer of the Indiana Railway & Light Company. At present the Fuel Administration for Indiana is attending only to domestic requirements and a very few emergency requests of public utilities.

HOPE OF COAL SUPPLY NOW IN THE RAILWAY POOL

Washington Information on the Coal Situation Looks to the Pooling of Yards, Trackage and Equipment

Analysis of the coal situation by the Washington representative of the ELECTRICAL WORLD, based on information at the Capitol, shows that considerable hope is pinned to the railroad pooling arrangement for relief from what is now undoubtedly a coal famine.

Washington is beginning to understand, according to the information, that coal buyers and users have been so befogged by conflicting statements from the railroads, the railroad war board, the priority-in-transportation agency, the Council of National Defense, the National Coal Association and the Fuel Administration, to say nothing of price fixing and the alteration of prices, that it has been difficult for them to plan for the future.

Now, the long-talked-of famine is here in some districts. Coal operators who have established national headquarters in Washington say that they are anxious and willing to correct the situation if they can, because their selfish interests will not allow them to shut down, but that they cannot get cars. In the Pittsburgh district coal output has been cut 60,000 tons a day because of lack of cars. Railroads still claim that they have cars but not enough power, and on the other hand stories are pouring into Washington from all sections reporting that both loaded and unloaded cars are being stacked on sidings, creating congestion which halts not only coal but other commodities.

The normal movement of cars to the mine, at the mine, to the consumer and back to the mine, empty, takes ten days. Last month this movement required, according to figures in Washington, from fifteen to forty days, with an average of twenty.

In these circumstances, the railroad arrangement to pool yards, trackage and equipment is looked forward to eagerly, and December is expected to tell the story of what industry will face. Comparatively mild weather, usual during that month, will give mine operators opportunity to do their best. The labor situation is said by operators to be satisfactory. If railroads do not move cars in sufficient quantity during that month, operators expect a long, hard pull in the effort to catch up, and say frankly that they need to get a good start to aid industry in storing some reserve for the winter.

Federal Fuel Administrator for Indiana
227 Federal Building
INDIANAPOLIS, INDIANA

_____ has notified us that

car _____ No. _____ has been shipped to

you on _____ to apply on your order No. _____

Please report its arrival and return of car to the railroad on the form below.

PLEASE SELL ONLY ONE TON TO EACH CUSTOMER. DO NOT ALLOW PEOPLE TO STOCK COAL

R 2

FEDERAL FUEL ADMINISTRATOR FOR INDIANA.
227 Federal Building,
INDIANAPOLIS, INDIANA.

The man in the trenches works overtime and Sundays.
Your return card shows you took a
pretty long time to get your car of coal unloaded.
The car supply must be helped.
Answer your conscience: - Don't write to me about it.
Were you a Slacker in getting the car unloaded?

POSTAL-CARD NOTICES DESIGNED TO EXPEDITE MOVEMENT OF COAL CARS

THE ELECTRICAL WORLD

STREET-LIGHTING TABLES

FOR 1918

Following its practice for twenty-nine consecutive years, the ELECTRICAL WORLD has prepared tables showing the proper time for lighting and extinguishing street lamps. The 1918 tables will be ready on Dec. 15, and a copy will be sent free to any reader upon request to the ELECTRICAL WORLD, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 10 cents per copy is made.

NEW SECURITIES ISSUED BY GENERAL ELECTRIC COMPANY

Issues of $10,000,000 of Two-Year 6 Per Cent Notes and $10,000,000 in Stock—Special Stock Dividend of 2 Per Cent

The General Electric Company has sold $10,000,000 of 6 per cent two-year notes, dated Dec. 1, to J. P. Morgan & Company and Lee, Higginson & Company. They were heavily oversubscribed. The notes were sold to the public to yield 6⅝ per cent income. It is reported that the net cost to the company was a little more than 7 per cent. This issue follows $15,000,000 of 6 per cent three-year notes, sold in July, at a net cost to the company reported at about 6½ per cent. The new notes, put out by the bankers at 98¾, sold early this week at 99¼.

Directors of the company have also voted to issue $10,000,000 new stock to shareholders at par. A meeting of stockholders will be held in Schenectady on Jan. 3 to vote on increasing the authorized amount from $105,000,000 to $125,000,000.

In addition to the regular quarterly cash dividend of 2 per cent, the directors declared a special semi-annual dividend of 2 per cent payable in stock at par on Jan. 15.

The total amount of new capital provided by the two note issues and the proposed new stock issue is $35,000,000. The company states:

The proceeds of the $15,000,000 three-year notes issued by the company in July, 1917, and of the $10,000,000 two-year notes which have just been sold are for temporary use made necessary by the increase in orders received by the company from $98,000,000 in the year 1915 and $167,000,000 in 1916 to $230,000,000 estimated for the year 1917.

This large increase has required extensions to manufacturing facilities which, from Jan. 1, 1916, to date, have amounted to $36,000,000, completed and in process of erection. The increase in inventories and in cust mers' notes and accounts in the same period is about $70,000,000.

As normal business conditions are restored, it is expected that sufficient capital will be released by the reduction of inventories and notes and accounts receivable to meet the $25,000,000 notes at their maturity.

	1917 (Partly estimated)	1916	1915
Orders received	$230,000,000	$169,582,058	$133,363,891
Sales billed	192,000,000	132,242,290	85,522,070
Net income (after all taxes) applicable to interest and dividends	27,000,000	19,160,973	12,307,995
Surplus at close of fiscal period, after paying interest and dividends	50,000,000	34,361,000	25,693,000

The $10,000,000 capital stock which it is now proposed to offer to the stockholders at par will supply all the permanent capital which it seems necessary to provide at present.

The directors have preferred to adopt the policy of paying semi-annual stock dividends at the rate of 4 per cent per annum in addition to the regular 8 per cent cash dividends, rather than to increase the rate of dividends or to distribute a larger stock dividend payable at one time. The decision to distribute stock dividends semi-annually in addition to the regular cash dividends has been reached in view of the large surplus account of the company, representing earnings invested in additional manufacturing facilities and working capital.

COURT DECISION IN THE FLEXIBLE CONDUIT CASE

Tubular Woven Fabric Company Upheld by United Circuit Court of Appeals in Long-Standing Litigation

A decision has been rendered by the United States Circuit Court of Appeals for the First Circuit in the patent suit between the National Metal Molding Company and the Tubular Woven Fabric Company. In the long-standing litigation involved, the Tubular Woven Fabric Company won the first case in the district court, in which the important feature was a paper-twine helical member of the tubing. That company lost on the appeal to the Circuit Court of Appeals. It therefore adopted a tube made with a cotton-yarn helical member. The National Metal Molding Company brought suit again. In the district court decision the Tubular Woven Fabric Company was upheld, and that finding was indorsed by the Circuit Court of Appeals on Nov. 14. The Osborn patent, which entered prominently into the case, expired on July 3 of this year.

The decision of Nov. 14 says in part:

The question whether the defendant's completed conduit involves two or three steps or elements is quite immaterial, if it results that its means of manufacture and its means of properly stiffening are substantially different from the means described and employed by Osborn.

We think the defendant produced its new conduit by combining elements old in the art under conditions which differ substantially from Osborn's conception, and by employing means which are quite independent of the means and combination which Osborn described. Osborn was not a pioneer inventor, and we do not think his claims should be so broadly construed as to include the defendant's new conduit.

ELECTRICALLY CONTROLLED RAIDERS MADE IN GERMANY

Interest in the New German "Electrically Controlled" Warships, but Disposition to Regard Them as "Philosophical Toys"

Navy Department officials in Washington expressed themselves as much interested in cable dispatches describing the so-called "electrically controlled" sea raiders which the British government reports were in operation off the Belgian coast.

The German ships, however, are regarded in high quarters in Washington, at least at this advance stage of their use, as merely "a very interesting philosophical toy." Government officials do not care to be quoted in regard to the German experiments. They, however, point to the fact that recent news dispatches from abroad are conflicting in that one says the German ships, several of which have been destroyed by the British, are controlled by wireless and another says they are controlled by a land wire.

POWER RATES TO MUNICIPALITY ARE INCLUDED IN FRANCHISE

New England Hydroelectric System Sells Energy for Railway with Possibility of Serving Municipality Also

Following protracted negotiations, the Turners Falls Power & Electric Company, one of the largest hydroelectric systems of New England, has been granted a franchise by the town of Westfield, Mass., to supply electrical energy to the Springfield Street Railway within the municipality and to build and operate a high-tension transmission line for this service. On account of the intense local interest in the municipal plant at Westfield the franchise does not permit the company to sell energy in competition with the town station, but provision is made in the agreement for rates in case of future purchases of electricity by the town from the transmission system. The franchise requires that power shall be furnished only to the railway company, and in the event of this provision being violated the location for the transmission line becomes void unless the town shall vote within two years to purchase power for municipal use from the Turners Falls company.

In case of such a vote power could be taken under two plans designated as "A" and "B." Prices under these plans would be as follows: First 1,000,000 kw.-hr., $0.012; second 1,000,000 kw.-hr., $0.011; all over 3,000,000 kw-hr., $0.009. Both plans contain a coal clause which would vary these prices in case the cost of coal on the power company's siding at its Chicopee Junction turbine plant is in excess of $4.50 per ton. In case the plans defined in the agreement are not acceptable, the price to be paid by the town is to be fixed by the Massachusetts Gas and Electric Light Commission.

LOCAL SECURITY SELLING FOR BYLLESBY FINANCING

O. E. Osthoff Says that Problems Now Being Worked Out Are No More Difficult than Those of Past

O. E. Osthoff, vice-president of H. M. Byllesby & Company, says in a statement regarding war and construction conditions and financing by the sale of securities of local operating companies in home territory:

At most properties extraordinary demands for power service, and at certain properties the requirements of army training camps, necessitate additional investment. Additions and extensions now in hand and planned for the next fourteen months will be financed partly by the sale of the individual companies' securities in their local territories. Our plan of local security selling has met with a gratifying measure of success. Northern States Power Company, Western States Gas & Electric Company, San Diego Consolidated Gas & Electric Company, Ottumwa Railway & Light Company, Oklahoma Gas & Electric Company and Arkansas Valley Railway, Light & Power Company all have large and growing lists of home stock and bondholders.

Public utilities are vital to industrial and social welfare as well as to war production. Our power companies are helping to build ships, extract ingredients for explosives from kelp, operate flour mills, mine ore, run munition and agricultural implement factories, and are assisting hundreds of establishments to increase the output of necessary articles. Every industrial plant connected to our lines is saving fuel compared with the consumption of isolated power plants. Besides this, 45 per cent of all power supplied by Byllesby companies is generated by water power. We have three army training camps at our properties—at Louisville, San Diego and Tacoma.

Increased operating expenses at some utilities have brought about a condition whereby the utilities are entitled to higher rates for service. The public and the utility commissions are recognizing the justice of increased compensation. We have found a spirit of fairness on the part of the public wherever these questions have been raised. One of our companies has obtained the consent of large power users to accept temporary advances in service rates by simply presenting the facts.

The Louisville Gas & Electric Company is now mining its own coal and shipping it in its own steel cars, wth a marked saving under current market prices, and the assurance of a plentiful supply. A new 15,000-kw. turbine recently placed in operation is expected to achieve still further economies. At Minneapolis a new 33,000-hp. steam turbine is being installed which will still further increase both the efficiency and capacity of this steam auxiliary station.

The problems now being worked out by public utilities are no more difficult than many which have been solved in the past and those met with in any business. Intrinsic values of securities based on these properties are as sound as they always have been.

REASONS FOR PRACTICAL ELECTRICAL CHRISTMAS

James M. Wakeman Says that the Industry Is Doing a Public Service in Urging Sensible Gifts for the War Christmas

James M. Wakeman, general manager Society for Electrical Development, New York, makes the following statement to the ELECTRICAL WORLD of reasons why Christmas gifts this year should be of practical electrical value:

1. It should be recognized that the buying needs of the public for the Christmas of 1917 are changed by the fact of war.

2. Business is going on far more actively than ever before, but it is not confined in the same channels as in past years. It is necessary that the electrical industry shall adapt itself to the new requirements of the public. It is doing so in urging that Christmas be made practical and electrical.

CHRISTMAS LITERATURE OF ELECTRICAL DEVELOPMENT SOCIETY

3. When labor is saved by the more intensive use of electricity it is a real economy. It is true conservation. The industry is doing a public service in urging sensible gifts for the Christmas season.

CAPITALIZATION OF CONSERVATION COSTS

Expenditures for the Conservation of Water and Industrial Real Estate Development Considered by Massachusetts Commission

Two interesting problems bearing upon capitalization were features of a recent stock hearing given to the Turners Falls Power & Electric Company by the Massachusetts Gas and Electric Light Commission. Lately the company has made considerable expenditures in the acquisition of land and flowage rights and in the investigation and development of storage at the sources of the Connecticut River and its tributaries for the purpose of conserving its flow. An investment has been made in this connection of $51,000 in 60 per cent of the capital stock of the Connecticut River Conservation Company, which was organized recently by the Turners Falls and New England Power companies with a view to co-operating in a plan for impounding the spring floods in the Connecticut River. Regarding the permanent financing of this expenditure the commission said in its decision:

> No question arises as to the propriety or value to the company and the public of this expenditure, but the method in which it is to be handled and shared with the other owners of the water privileges on the river, while of the utmost importance, is complicated by the relation of this stream to four states and in its navigable reaches to the federal governnment. The necessity of co-operation in some plan of legislation to control and equalize the stream flow by utilizing the spring floods is manifest. The expenditures so far incurred do not need to be considered in connection with this petition, and before its permanent financing is undertaken the solution of the problem can be more fully studied and considered.

The extent of the work of these two hydroelectric companies in the Connecticut River Conservation Company, as described by President Philip Cabot of the Turners Falls company, is material. Although the permanent financing of the cost of such conservation remains to be accomplished and approved by the board, its recognition of the propriety of the expenditures already incurred in conservation by mutual arrangement and co-ordinated investigations deserves emphasis.

The other issue dealt with the expenditure by the Turners Falls company of about $16,700 in the erection of a building on land adjoining its canal for lease to a manufacturer, and at the hearing President Cabot pointed out that if the company had not made this expenditure, the manufacturer might not have located in Turners Falls. This raised the question as to whether the board shall approve new securities for an expenditure of this character where the real estate is to be occupied by a prospective user of electric power.

"It is part of our business," said he, "to attract manufacturers to Turners Falls and take care of them to some extent when they get there. In this case the company built a cutlery factory for the Hinckley Manufacturing Company and leased it to that company for a term of years on the basis of 6 per cent net on the cost of the land and buildings." President Cabot pointed out that as a result of the hydroelectric company's co-operation experienced cutlers previously unable to find work in Turners Falls returned from less profitable tasks in a near-by town.

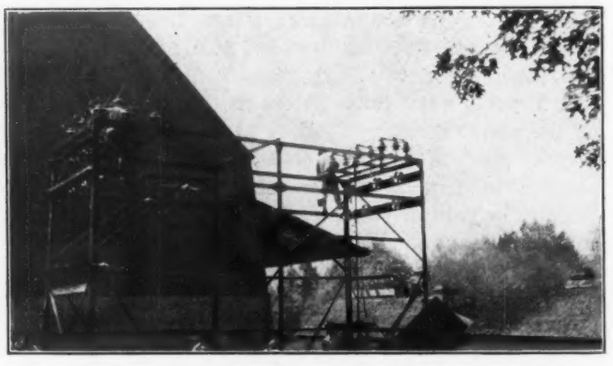
The commission did not allow the above outlay to be capitalized in the case before it, but did not discuss the policy in any extended way. At the hearing there was a disposition on the part of the board to recognize the company's public spirit, subject to financing outside capitalization.

EXEMPTION OF EMPLOYEES FOR INDUSTRIAL REASONS

Relation of Georgia Railway & Power Company to Maintenance of Military Establishment, the Military Forces and National Interest

A memorandum on the subject of exemption from military service for industrial reasons was prepared recently by the Georgia Railway & Power Company for the information of the district board of the northern district of Georgia. This was done in order that the board might have data before it in determining the relation of the company to the maintenance of the military establishment, the effective operation of the military forces and the maintenance of the national interest during the emergency.

The company shows that its transmission and distributing lines now aggregate over 500 miles (800 km.) in length and traverse twenty-one counties of northern



LIGHTNING ARRESTERS AND DISCONNECTING SWITCHES

Georgia with a population of over 700,000. The company is generating and distributing approximately 22,500,000 kw.-hr. of hydroelectric energy per month. It serves forty-three towns and municipalities with electrical energy for lighting and power purposes.

In the conduct of its business in furnishing transportation facilities and light and power service in the territory served, the adequate and effective operation of the Georgia Railway & Power Company is, the company says, "necessary to the maintenance of the military establishment, necessary to the effective operation of the military forces, and necessary to the national interest during the war."

As indicating the relation of the company to the military establishment the memorandum states:

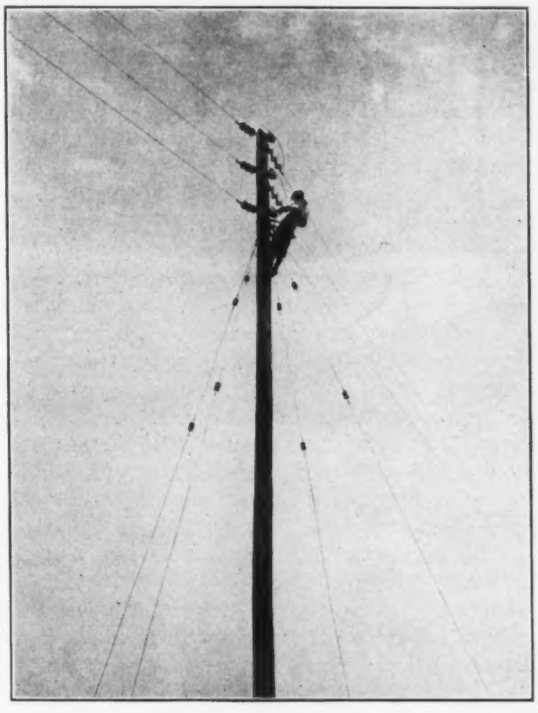
> The Georgia Railway & Power Company furnishes the electrical energy with which the Officers' Reserve training camp at Fort McPherson is lighted and also with which the fort proper is lighted. It furnishes the most frequent and reliable means of passenger transportation between the training camp and the fort and the city of Atlanta.
>
> It is preparing to furnish the energy for lighting the grounds, the streets and the buildings at Camp Gordon; also the power for pumping water throughout the camp community, as well as pumping it to the camp site.
>
> It supplies the energy for operating the signal system controlling all the trains operating on the Southern Rail-

way by and to and from the camp and hauling the material to and carrying the workmen to and from the camp site. The adequate and effective operation of this signal system is necessary to the adequate, efficient and safe operation of this division of the road.

It has in course of construction a railway line to the camp site for use in furnishing passenger transportation facilities between this camp and the city of Atlanta, the agreement to furnish these transportation facilities and service being a condition precedent to locating the camp on the site selected.

The service to be furnished by this company is necessary to the maintenance of Camp Gordon and to the continued occupancy of Fort McPherson and is therefore necessary to the maintenance of the military establishment.

Many of the industries shown on a list attached to the memorandum are making war materials and supplies which are essential to the effective operation of the military forces. In most cases these industries are solely dependent on electrical energy supplied by the



TYING IN A STORM-GUYED STRAIN CORNER IN CONSTRUCTION FOR CANTONMENT

Georgia Railway & Power Company. Quotations from replies received from some of these industries show their dependence on the company for power.

Setting forth the relation of the company to the national interest during the war, it is stated:

The forty-three cities and towns served by the Georgia Railway & Power Company, including the city of Atlanta, are dependent upon the company for electric light and power service, including the power for operating their respective waterworks systems.

In the city of Atlanta the company supplies from its hydroelectric plants the energy for street lighting, residence lighting, for lighting business houses and office buildings, churches and theaters, and the power for propelling the street cars within the city and on the suburban and interurban lines; power for lifting elevators, for pumping water at the Atlanta waterworks and for operating various and numerous light manufacturing establishments. The adequate and effective operation of the company's power plants and transmission and distributing systems is of supreme national interest in the territory served. It is the backbone of the commercial activity of the northern section of the State. If the hydroelectric plants of the company were interrupted for any length of time, the entire business activity of this section of the State would cease, the forty-three cities and towns served would be without water and lights, transportation facilities within the city of Atlanta and suburbs would stop, factories would cease to operate, and upward of 15,000 people would be thrown out of industrial employment.

A great majority of the industries served have no other source of power, and even though they had steam plants available, under present conditions it would be practically impossible to secure the coal necessary to generate steam power and also impossible to secure the men necessary to operate individual steam plants. With the present high price of coal, the scarcity of labor and the shortage of coal cars it is a great economic loss and an inexcusable national waste to generate steam power when hydroelectric power is available.

The generation and transmission of electric energy from our water powers consume no materials, require a minimum of men, draw no supplies from outside the territory, and appropriate no part of the country's railroad facilities.

The use of this hydroelectric energy in furnishing the power for and running the factories and industries of the territory releases the coal, materials, transportation facilities, engineers, mechanics and laborers which would otherwise be required by the isolated steam-power plants it displaces.

In view of the extent and character of the services performed by it we can conceive of no particular industry the adequate and effective operation of which is more essential to the national interest at the present time than the Georgia Railway & Power Company.

The company has in its employ over 2200 persons. Many of these are subject to military service in the National Army. The policy of the company has been to encourage those who could be spared from the organization to enlist in the service of the country. There are a number of technically trained and experienced men in the organization whose services are necessary to the adequate and effective operation of the company and who could not be replaced by other persons without direct, substantial, material loss and detriment to the company's service. In such cases, where the men are called, we will be under the necessity of requesting that they be exempted for the reasons stated.

WORKING AGAINST THE SUBMARINE DANGER

Important Progress Announced in Washington on Inventions to Combat the German U-Boat Menace—40,000 Suggestions Made

Secretary Daniels announced in Washington that "important progress" has been made by inventors who are working with the Naval Consulting Board. Thomas A. Edison, chairman of the board, is now residing in Washington, occupying the old room of the late Admiral Dewey in the offices of the general board of the navy, and is giving all his time to the government in connection with inventions for the prosecution of the war.

One of the most skilled technical inventors in the naval service, it is announced, is perfecting, with the co-operation of Mr. Edison, Capt. Williams Strother Smith, U. S. N., and specialists assigned by Mr. Daniels, a device in the direction of detection and destruction of submarines. Necessarily secrecy is thrown over what is being done, and plants where experiments and other work is being done are under extra guard.

Secretary Daniels says that more than 40,000 separate suggestions have reached the Naval Consulting Board, that all have received attention, and that some have been of sufficient importance to assist in collateral plans to cripple submarines.

CHANGES IN PERSONNEL OF ENGINEERING FACULTIES

Further Listing of Resignations, Leaves of Absence, Promotions and Appointments in the Electrical Teaching Body of the United States

Following is the third installment of the record of resignations, leaves of absence, promotions and appointments in the electrical engineering faculties of the various colleges and universities of the United States. Previous articles were published in the issues of Nov. 3, page 878, and Nov. 24, page 1022.

State College of Washington, Pullman, Wash.—The only change which has taken place in the teaching staff of the electrical engineering department is the promotion of Prof. H. V. Carpenter from head of the department of mechanical and electrical engineering to that of dean of the College of Mechanical Arts and Engineering.

Stevens Institute of Technology, Hoboken, N. J.—Prof. L. A. Hazeltine has succeeded the late Professor Ganz as acting professor of electrical engineering in charge of the department. Professor Hazeltine had been in the department for the last ten years. Frank C. Stockwell has been advanced from instructor to assistant professor of electrical engineering, and F. S. Cummings has been advanced from assistant to instructor in the same department.

Syracuse University, Syracuse, N. Y.—Rich D. Whitney has been advanced from the grade of assistant professor to that of associate professor of electrical engineering. C. W. Henderson has been added to the teaching staff as instructor in electrical engineering. He comes from Dennison University, where he has been an instructor in physics.

Union College, Schenectady, N. Y.—W. B. Kirke, who last year was instructor in electrical engineering, is at the present time connected with the research department of the General Electric Company, and his position has been filled by M. K. Ts'en. Mr. Ts'en was graduated from Cornell University three years ago and did one year and a half of graduate work at Union College, receiving his master's degree in electrical engineering. During the last year Mr. Ts'en was engaged in engineering work in China.

University of Arkansas, Fayetteville, Ark.—Adjunct Prof. W. B. Stelzner is on leave of absence pursuing postgraduate work in the University of Ohio. Hugh A. Brown, assistant in electrical engineering, is on leave of absence in the service of the government, giving instruction in wireless telegraphy at the aviation camp at Urbana, Ill. Prof. W. H. Wadleigh, A. B. and M. S., from the University of Michigan, succeeds Mr. Stelzner. Professor Wadleigh was in the department of physics and electrical engineering of Fairmount College, Wichita, Kan. H. F. Lickey was appointed assistant in electrical engineering, to take the work formerly done by Mr. Brown. Mr. Lickey is a graduate of the 1913 class of Purdue University in electrical engineering and since graduation has spent most of his time with the Westinghouse Electric & Manufacturing Company at Pittsburgh, Pa. Mr. Lickey is giving special instruction in sending and receiving wireless messages, to prepare men for the army and for the Aviation Corps.

University of Cincinnati, Cincinnati, Ohio.—C. R. Wylie has resigned as assistant professor of electrical engineering. V. T. Mavity has accepted an instructorship in the department. Mr. Mavity is a graduate of Purdue, 1913, and has spent three years in Central America in electrical engineering work. L. M. Alexander has also accepted a position as instructor in the electrical engineering department. Mr. Alexander is a graduate of the university's cooperative course, and in addition to the practical experience connected with the co-operative course has been doing practical work for two years since graduation.

University of Illinois, Urbana, Ill.—J. W. Davis, instructor in electrical engineering, has entered the aviation corps of the United States government. P. J. Nilsen, instructor in electrical engineering, has accepted a position with Arthur Young & Company, Chicago. R. S. Quick, research fellow in electrical engineering, has entered military service. E. A. Reid, formerly instructor in electrical engineering at the University of Minnesota, has been appointed instructor in electrical engineering. W. R. Lyon, who was graduated from the Worcester Polytechnic Institute, June, 1917, has been appointed research fellow in electrical engineering.

University of Kansas, Lawrence, Kan.—S. S. Schooley has been appointed as instructor in electrical engineering to take the place of E. E. Hartman, resigned. Mr. Schooley is a graduate of the University of Kansas in 1913 and comes to the electrical engineering department from the engineering department of the Bowersock Milling & Power Company of Lawrence, Kan.

SURVEY RICHMOND (VA.) MUNICIPAL UTILITIES

Hagenah & Erickson Recommend Adoption of Office Methods and Policies More Nearly Akin to Those of Private Utility Corporations

A survey of all departments of the city government of Richmond, Va., including the municipally owned gas, water and electric plants, has just been completed. The survey, except the work pertaining to the utilities, was made by the Bureau of Municipal Research, New York, the utility investigation being made by Hagenah & Erickson, consulting engineers, Chicago.

The utilities section of the work embraced a study of office methods pursued by the city in administration of these properties, the accounting systems in use and practices under such systems, and analysis of the rate schedules. The report of the engineers criticises some of the methods now in use and recommends the adoption of office methods and policies more nearly akin to those followed by private utility corporations, in so far as the nature of municipal ownership will permit. Many recommendations are made with respect to the accounting systems now in use, which are criticised, especially the accounting systems of the water and electric departments. The engineers recommend that separate classifications of accounts, such as are now generally prescribed by public utilities commissions, be adopted by each of the three utility departments to the end that the operations of such departments may be shown independently, charges being made for service supplied to the city or to another municipal utility in the same manner that charges would be made for such service if rendered to individuals, and that proper credit be given by each utility for the benefit it receives from expenditures made on its account by some other city department, or for the personal services, in whole or in part, of any individual who is not employed by the utility itself. It is stated that only through the adoption of and strict adherence to such a classification of accounts is it possible to determine whether the utility departments are being operated at a profit or a loss.

Extended analyses were made of the financial operating records of the gas and water departments and of the records of consumers in these departments in order to ascertain the extent of the service development and the proper application of the particular rate schedules now in force to the service conditions as disclosed. Recommendations are made suggesting the advisability of radical changes in the schedule for water service, and changes of a lesser degree are recommended with respect to the gas rate schedule. The electric utility is operated solely in the service of the city, no commercial service being supplied.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Abandonment of Unprofitable Line.—The Utah Public Utilities Commission holds in a case affecting the Emigration Canyon Railroad Company that a railroad company makes out a case for the abandonment of its road where it is shown that the purpose for which it was built has ceased to exist, that the road is operated at a loss, that there is no prospect for any change in the situation, and where it appears that there is no question as to connection with other railroads or any charter or other obligations to estop it. The mere fact that numerous persons have purchased lands and made improvements thereon in the belief that a railroad will be operated is not, as a mater of law, a sufficient reason to require its continuance.

Recognizing the Economic Changes.—The Washington Public Service Commission, in authorizing the Puget Sound Railway, Light & Power Company to discontinue a low ticket rate of fare on its cars, says: "This commission would be remiss in its duty if it failed to recognize the economic changes which have taken place and are still taking place and the unbalancing of activities. We are passing from a peace to a war footing. Under these conditions few, if any, of the old relationships can continue to exist. If we have any power to aid in the readjustment of matters that new conditions may be met, we should be fair enough to exercise it. Every article which the company must purchase to maintain its properties is abnormally high."

Construction Order Modified Because of Abnormal Costs.—On account of abnormal costs, the Maine Public Utilities Commission has modified an order requiring the Grand Trunk Railway Company to install block signals. Its decision says: "Serious as business conditions were when the original report in this case was made, it is well known that they have since become very much more serious. Present cost of labor and materials and the difficulty in procuring either, more especially the latter, make extensive construction practically out of the question. In addition to these considerations, governmental authorities generally have expressed the wish that transportation lines be hindered as little as possible in the immediate carriage of freight. We shall therefore not now insist upon present compliance with the full recommendation as originally made. We shall order a substantial beginning through the more congested part of respondent's lines within the State and suspend further action until the subject may again be properly considered."

Rate Advance to Cover Increased Cost.—The Illinois Public Utilities Commission, having denied the utility companies' applications for permission to insert a coal clause in their rate schedules in the two Rockford cases, has taken the stand in the case of the Warren Light & Power Company that rates may be advanced to meet increased operating expenses due to higher wages, cost of material, supplies and coal, the coal increase being estimated on the price fixed by the federal government. The commission permitted the advance on a showing of efficiency and management, though the risks of the undertaking appeared to be normal and the existing rates would yield a return of approximately 7 per cent upon the tentative valuation of the property.

Unremunerative Service Not Required.—A ruling of the Washington Public Service Commission in the case of George F. Yantis against the Olympia Light & Power Company holds that, although a person lives within the corporate limits of a city, that does not justify him in demanding service from a public service corporation if the income in sight would require ten years to reimburse the company for the expense of installation, without anything for upkeep, service or depreciation. Mr. Yantis lives within the corporate limits of Olympia, and he wanted lighting service. The company found that the cost would be excessive, and refused to install service unless Mr. Yantis would buy two shares of capital stock to provide the money. This he declined to do, and appeared before the commission, which found that his demand was not a reasonable one.

Present Valuation and Higher Rates.—The Massachusetts Board of Gas and Electric Light Commissioners in allowing the Newburyport Gas & Electric Company to increase gas rates for the duration of the war says: "The board has not felt that it is in the public interest to attempt to determine in any final way the fair and reasonable price of gas in Newburyport or elsewhere at a time when the cost of every item entering into the construction, operation and financing of gas plants has reached exceptional and unprecedented levels. It may be confidently hoped that this abnormal situation will not outlast the war. When normal conditions are restored it will then be possible to reach just conclusions, resting on reasonable and stable grounds. Meantime some relief should be granted, although both consumer and stockholder must realize that in a time of great stress and in meeting conditions for which neither is responsible there must be sacrifice and self-denial on both sides. In the opinion of the board the price hereinafter named will give the company a reasonable measure of relief which, in conjunction with all the business of the company, will tide it over the present emergency. Should experience demonstrate that a higher or a lower price is called for to discharge the natural obligations of the consumers, a modification of this order will be made."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Regulation of Rates.—Under the code, which authorizes cities to regulate and fix the rents of electric light or power, etc., and to fix the charges for meters, where a franchise to sell and distribute electricity fixed maximum prices per kilowatt, without fixing or authorizing any charge for meters, the maximum price could not be increased through the addition of a meter rental or other device or subterfuge for increasing the stipulated compensation, the Supreme Court of Iowa held in Iowa Railway & Light Company versus Jones Auto Company (164 N.W. 780). The power to fix rates in this case is a continuing power, and rates may not be fixed permanently or for any specified time by ordinance or resolution or through any contract. Under the code, which further provides that franchises shall not be granted, renewed or extended for the use of the streets, etc., unless a majority of the legal electors vote in favor thereof, the rates specified in a franchise granted by the city to construct and operate a heating plant system for supplying heat to the city and its citizens were subject to subsequent adjustments, as might be deemed expedient or necessary by the City Council, though the franchise was granted with the approval of the electors. Under the sections providing that articles of incorporation, etc., of corporations shall be subject to legislative control, and may be altered, abridged or set aside, and that every franchise obtained, used or enjoyed by any such corporation may be regulated, withheld or subjected to conditions, where a city council changed the rates specified in a franchise to construct and maintain a heating plant, there was no impairment of the obligation of the so-called contract. A city council's authority to regulate and fix rates charged by a company granted a franchise to construct and maintain a heating plant system for supplying heat was not limited to reducing the rates specified in the franchise, but included the power to increase them, and it was not essential that the change of rates should rest on a new consideration. An increase by a city council of the rates specified in a franchise to construct and maintain a heating-plant system was not invalid, though at the time the code contained no provision for the amendment of the franchise, as, in view of a supplement to the code, which must be read into the franchise, this did not amend the franchise but carried out its terms, and it was immaterial that the fixing of the rate was accomplished by an ordinance amending the section of the franchise specifying its rates.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 1086 of this number.

Worcester Branch of the A. I. E. E.—Carlyle A. Atherton addressed the second regular meeting of the Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers on Nov. 16 on the subject of "An Electrical Engineer in Germany and in England Under War Conditions."

Relation of Science and Engineering to War.—Major R. A. Millikan, vice-chairman and executive officer of the National Research Council, Washington, D. C., addressed a joint luncheon meeting of the Electric Club-Jovian League and the Chicago Section, A. I. E. E., at Chicago, Nov. 27. Major Millikan was formerly connected with the physics department of the Chicago University.

Toronto Section, A. I. E. E.—Three papers were read and discussed at the Nov. 16 meeting of the Toronto Section of the A. I. E. E. The papers and authors were as follows: "A Commercial Method of Taking the Ratio of Current Transformers," by Harry S. Baker, Ontario Power Company; "Demand Meters," by Perry A. Borden, Hydro-Electric Power Commission; "Relays," by C. W. Baker, Canadian Westinghouse Company.

"Hooverizing Electricity."—A special meeting of the Jovian League of San Francisco was called for Nov. 19 to listen to a discussion and suggestions on the subject of "Hooverizing Electricity." The subject was presented by Max Thelen, president of the California Railroad Commission, with the support of Messrs. Loveland, Gordan, Edgerton and Devlin, who are the other members of the commission, and F. Emerson Hoar, the commission's electrical engineer. Albert H. Elliot, secretary of the Pacific Coast Electrical Jobbers' Supply Association, was named as chairman of the day to introduce the speakers.

Empire State Gas and Electric Association.—At a recent executive committee meeting of the Empire State Gas and Electric Association the following plan for the appointment of various committees was approved: (1) The executive committee would authorize the following committees or sections: Commercial committee, gas production committee, gas distribution committee, electrical production committee, electrical distribution committee, electrical meter committee. (2) Each member company would be asked to name, on form provided, representatives to be the official members of these committees or sections. All notices of meetings of these committees or sections would then be sent to the persons thus named. (3) At the first meeting of each section the members would elect from the official company representatives a chairman, a vice-chairman and a secretary, who would act as an executive committee of such section. These persons would hold office for one year from the date of their election.

Production of Steam from Coal.—Alex Dow, president and general manager of the Detroit Edison Company, addressed a meeting of the Schenectady Section of the American Institute of Electrical Engineers on Nov. 23 on the subject of "Production of Steam from Coal." On Nov. 13 G. H. Stickney, president of the Illuminating Engineering Society, outlined the general problems of the illuminating engineer, and Dr. Clayton H. Sharp, technical director of the Electrical Testing Laboratories of New York, addressed the meeting on the "Terminology and Measurements of Illuminating Engineering."

Meeting of Middle West Credit Men at Chicago.—The twenty-second annual meeting of the Electrical Credit Association of Chicago was held at the Hotel La Salle on Nov. 15 and 16. Membership has increased to 293 members, including 38 enrolled during the last year. One day was given to papers and discussions. The topic taking the greatest time and which was the most discussed was, "Trade Acceptances, Merits and Faults." The discussion was led by W. J. Burton. A resolution was passed in effect favoring the adoption and use of trade acceptances as rapidly as members individually deem it expedient to change from the open-account method.

New York Electrical Society Receives Handsome Donation.—A handsome donation has just been made to the New York Electrical Society by Willard E. Case of Auburn, N. Y. While the amount of the gift has not yet been made public—at the desire of Mr. Case—it is sufficient to defray all the liabilities of the society and leave a substantial sum for the carrying on of its special work. George E. Guy, who is secretary, also announces that the membership committee, of which Walter Neumuller is chairman, is engaged on an active and far-reaching campaign and that the society looks for the largest accession to its membership in its history this season.

Work of American Association of Engineers.—A letter written by the committee on ethics and co-operation of the American Association of Engineers, Chicago, has been sent by President Edmund T. Perkins of that organization to the presidents of the various engineering societies in the United States. The letter says, in part: "Our association is not endeavoring to rival but rather supplement existing activities and to do those things which many of the older established bodies have considered to be beyond their functions and yet which from the standpoint of the engineer as a man and a citizen should have careful consideration. It is our desire not to interfere in any way with the established customs of existing societies, but rather to co-operate and to a certain extent incite effort in the fields which so far have been hardly touched."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Central Station Organ Reviews Technical Articles for Operators.—The Consumers' Power Company, Jackson, Mich., through its official organ, the *Ausable News*, is calling the attention of its operators to articles which they should read in various technical papers. In this way subjects of special importance in the company's mind can be emphasized when they might go unnoticed by the operators.

Complication Over Increase in Rates in Kentucky.—An application for an increase in rates has been withdrawn by the Kentucky Public Service Company at Bowling Green, Ky., where it was discovered that the question could not be settled by ordinance. The company announces that it will continue at a financial sacrifice in the hope that supplies will become less costly, or until it becomes necessary to ask for an altered franchise.

Threshing by Electric Light.—The *West Penn Bulletin*,, published by the West Penn Power Company and West Penn Railways Company, Pittsburgh, reports an instance of threshing by electric light. Owing to labor shortage it was impossible to get men to do the threshing on the farm by daylight. A canvass for men who work in shops in the daytime was made, and enough were secured to do the work. Lamps were placed in the barn.

Control of Spokane Company.—Field, Richards & Company, Cincinnati, have bought the interests of Harry A. Flood, president of the Spokane (Wash.) Heat, Light & Power Company. Mr. Flood has resigned and will be succeeded by Ludwig Kemper, representative of Field, Richards & Company in Spokane. The holding company will be discontinued as a medium for controlling the operating company, the stock of which will be distributed share for share among shareholders in the holding company.

Data on Commonwealth Edison Income and Expenses.—In a report of Samuel Insull's speech before employees of the Commonwealth Edison Company in Chicago on Oct. 25, reported in the Nov. 3 issue of the ELECTRICAL WORLD, errors were made in publishing the table of data. The annual report of the Commonwealth Edison Company for the year Dec. 31 shows that the taxes and municipal compensation for this year were $1,835,912. This item was given in the table as "taxes and insurance." The item "bonded indebtedness" should have read "bond interest." The printed table contained two items listed "depreciation"; the second one should have been designated "dividends."

Men of the Industry

Changes in Personnel and Position—Biographical Notes

E. H. Davis of Houston has been appointed manager of the Texas Gas & Electric Company at Center, Tex., to succeed E. A. Davidson, who has resigned.

J. R. Baldwin has been promoted in the transmission division of the engineering department of the Georgia Railway & Power Company to be engineer of design.

W. R. Smith, formerly division foreman for the Public Service Electric Company, Newark, N. J., has been transferred to the position of field engineer, engineering department.

Frank R. Bacon, president of the Cutler-Hammer Manufacturing Company, has been commissioned a major in the Officers' Reserve and is now stationed at New Haven, Conn., with the Quartermaster's Corps.

William G. Martin, who for the last twelve years has been auditor for the Danville (Ill.) Street Railway & Light Company, resigned Oct. 1. Mr. Martin is taking a well-deserved rest before forming new connections.

J. F. Sells of the engineering staff of the National X-Ray Reflector Company has been appointed consulting illuminating engineer for the new-business departments of the Henry L. Doherty Company central stations. Mr. Sells is at present at Mansfield, Ohio, where the Doherty company operates the Mansfield Electric Light & Power Company.

D. C. Durland, works manager of the Sprague Electric Works of the General Electric Company, with which he has been connected for the last twenty-three years, has resigned to become president of the Mitchell Motor Car Company on Jan. 1. Mr. Durland was a member of the board of governors of the Associated Manufacturers of Electrical Supplies.

James H. Ellis, research associate in physical chemistry at Throop College of Technology, Pasadena, Cal., has become a member of the physics department of the college as instructor in electrical measurements. Mr. Ellis was graduated from the Massachusetts Institute of Technology in 1912 with the degree of bachelor of science and in 1916 with the degree of doctor of philosophy. He was assistant in the electrical laboratory of the Massachusetts Institute of Technology in 1913-14 and research associate in physical chemistry at the same institution from 1914 to 1916.

R. B. Howland, until recently assistant general superintendent of the Mississippi River Power Company, Keokuk, Iowa, is now in Philadelphia in the service of the American International Corporation, which is organized to promote foreign trade. Mr. Howland was graduated from Drury College in 1906 and took the degree of B.S. in electrical engineering from Purdue University in 1910. After work on the Pacific Coast, he went to Keokuk, where he held successively the positions of construction foreman, system operator, substation superintendent and assistant general superintendent.

John B. Pennington, who was connected with the municipal waterworks of Gloucester City, N. J., as chief engineer, has resigned.

William Insull, who recently was appointed district manager of the Kentucky Utilities Company at Elizabethtown, Ky., has been commissioned first lieutenant in the Signal Corps.

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, Newark, N. J., has been elected chairman of the war board of the American Electric Railway Association.

P. H. Adams, heretofore field engineer for the Public Service Electric Company, Newark, N. J., has been transferred to the position of assistant engineer, engineering department.

W. H. Leighliter has been transferred from the post of operating engineer at the main power plant of the West Penn Power Company to be superintendent of the Butler power station. Mr. Leighliter formerly held a similar position at the Creighton power station.

John M. Rodger, who has been manager of the Cleveland office of the ELECTRICAL WORLD and *Electrical Merchandising*, has been made Western manager of these two papers with headquarters at Chicago, succeeding Sam A. Hobson, resigned. Mr. Rodger was formerly in the Chicago territory as assistant to Mr. Hobson and prior to that time was sales representative in the Central Western territory for the Duplex Metals Company and other electrical concerns.

John Hunter, chief engineer of power plants of the Union Electric Light & Power Company, St. Louis, Mo., has been commissioned to supervise the construction of a large number of freighters and transports at the Passaic River (N. J.) shipyards. Mr. Hunter has had considerable experience in the building of ships for transatlantic service. He was chief engineer of the liner St. Paul during the Spanish-American war. He went to St. Louis as chief engineer for the Union company in 1905.

E. M. Walker, who resigned as general manager of the Dubuque Electric Company early in September, has been appointed general manager of the Terre Haute division of the Terre Haute, Indianapolis & Eastern Traction Company. In this capacity Mr. Walker will have full charge of the electric lighting and power work in the city of Terre Haute and a number of surrounding suburban towns, the city street railway system in Terre Haute and the interurban division radiating from Terre Haute.

H. M. Byllesby, president of H. M. Byllesby & Company, Chicago, has been made a major in the aviation division of the Signal Corps of the United States Army.

Fred M. Rosseland has resigned as safety inspector for the Chicago Telephone Company to become safety engineer for the National Safety Council, Chicago.

T. K. Jackson, manager of the Mobile Electric Company, has been appointed a member of the State Central Committee, having in charge fuel distribution in the State of Alabama.

J. E. Fitzgerald, formerly of the purchasing department, has succeeded T. P. Kindig as assistant to the general commercial manager of the United Gas & Electric Engineering Corporation.

C. B. Borden has been appointed superintendent of the Westboro (Mass.) Gas & Electric Company to succeed H. F. Hemenway, who resigned to take a position at the Springfield Arsenal.

J. F. McGuire, manager of the Minot (N. D.) division of the Northern States Power Company, has been appointed on the committee in charge of the United States Signal Service Corps School, opened at Minot on Nov. 15.

Albert V. Miller of the Metropolitan Edison Company, Reading, Pa., has resigned to become superintendent at the plant of the Lebanon Steam Heating Company, Lebanon, succeeding George Krall, who resigned because of ill health.

R. B. MacDonald, formerly general manager of the Fort Dodge (Iowa) Gas & Electric Company, has been appointed general manager of the People's Power Company, which operates in Moline, Rock Island and other surrounding Illinois towns, succeeding the late Dugald Porter.

Charles W. Mullen, formerly a member of the Maine Public Utilities Commission, is now in control of the newly incorporated Great Eastern Paper Company of Bangor, Me., which holds the development rights of 27,000 hp. on the Madeline River watershed in the Province of Quebec, Canada.

F. A. C. Tocque, until recently commercial manager of the Fort Smith (Ark.) Electric Light, Power & Traction Company, has sailed for England, where he will enter the British army. Mr. Tocque, who is an Englishman, was formerly district salesman of the Louisville Gas & Electric Company.

T. P. Kindig, for the last four years assistant to the general commercial manager of the United Gas & Electric Engineering Corporation, has left the organization to enter the war, having obtained an appointment to the United States Army Aviation Corps. Mr. Kindig joined the organization some eight years ago as a salesman in Colorado Springs and was promoted to be commercial manager of the Leavenworth (Kan.) Light, Heat & Power Company, from where he was called to assist the general commercial manager at the New York office.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

TRADE ACCEPTANCES MEET WITH MORE FAVOR

Electrical Jobbing Industry Taking Steps to Make Assets More Liquid Through Use of This Form of Credit Extension

A very definite movement is on foot throughout the country toward a general adoption of the trade acceptance. Ever since the Federal Reserve banking system was inaugurated early in the first Wilson administration the use of the trade acceptance form of extending credit in place of the customary open-account scheme has been urged by the Treasury Department through the principal reserve banks. While new in name only, trade acceptances have not been widely used. There seemed to be little desire to change over from the open-account system owing largely to a lack of understanding in the many trades of the trade acceptance plan, its use and value.

In this connection it is interesting to note the tendency of the electrical industry, particularly the supply jobbers, to make an extensive use of the new plan. On the Pacific Coast the use of trade acceptances by electrical jobbers is fast supplanting the open-account system. At the fall meeting of the Atlantic division of the Electrical Supply Jobbers' Association a resolution was adopted recommending that all members put trade acceptances into use with their customers, beginning the first of November. Already a majority have done something toward introducing trade acceptances, and more are planning to do so shortly.

The next step was taken at the meeting of the association at Cincinnati a couple of weeks ago, when the members voiced their approval of the use of trade acceptances.

Added impetus is being given to this movement by the Trade Acceptance Council, which was formed to further the use of acceptances through education and publicity. Local committees, acting under the guidance of the council, will be formed in all of the important trade centers.

As a war measure to strengthen the credit resources of the nation as well as the industry, the use of trade acceptances is being urged. It is now well recognized as a means of making liquid, as and when desired, the non-frozen assets represented by open accounts.

FIGURING DISCOUNTS FROM DATE OF INVOICE

Backbone and Real Nerve on the Part of the Seller Are All That Are Required to Enforce This Policy

Some companies buying goods insist, after the purchase has been made, that they should be allowed to take their discount for payment within ten days after the goods are delivered, even though the seller's purchase terms specifically include the statement, "Discount ten days from date of invoice." When the check from the purchaser reaches the seller within ten days from the date of arrival of the goods, but on account on the delivery situation many days after the date of the invoice, minus the 2 per cent or whatever the discount may be, the seller must decide what he will do with the check. It has been noticed that large corporations, and especially those in the automobile trade, seem to be the worst offenders along this line. That such is the case, it has been brought out repeatedly by credit men, is not because the corporations determine that they shall pursue that policy, but because the man who handles that sort of work is usually so far behind that he actually cannot get his work out in the specified discount time, and he likes to keep his own shortcomings covered up.

The only real solution for this trouble, as stated by a number of representative manufacturers and jobbers, is for the seller to display his courage and return the check, pointing out to the customer that purchase terms carry very definitely the understanding that discount will only be allowed if payment is made within ten days from the date of the invoice. The customer, of course, may consider this unfair because he does not care to pay for goods before he has seen that they are in accordance with specifications. Some purchasers, however, have met the situation by using a rubber stamp which says "Payment will be made within ten days subject to corrections upon receipt of goods." Some companies which have had trouble with purchasers taking time in this manner keep a card record of the regular offenders and treat them as such.

EXPEDITING ALL ORDERS OF A "WAR" CHARACTER

Manufacturers Everywhere Give Priority to Work in Which the Government Is Interested—Method of Procedure

A few companies have formally notified the trade that if shipments of material are directly or indirectly entering into the manufacture of munitions and other necessary supplies for the war the orders will be expedited in every possible way. In these commitments it is specified that the destination and how the merchandise is to be employed must be stated. It appears, in this particular connection, that advantage is taken of current conditions by some buyers—none too scrupulous, reports say, when it comes to gaining an advantage for themselves, or maybe a customer in dire need of equipment or supplies which ordinarily would be "held up."

One of the representative distributers, in referring to this matter, said that while no notice had been given the trade, nevertheless all orders requesting priority of shipment on government claims were subject to the most careful scrutiny. The War Department, for example, in making an inquiry for prices or in placing an order, used a definite number on all of its transactions. Consequently, if a customer stated that the material or accessories purchased were to be part of or wholly devoted to the purpose of the government, the official number was requested and must be "proved up" before preference was accorded the shipment.

Other prominent concerns follow the same procedure, even if buyers have not been cautioned in advance. A certificate from the Priority Board is frequently insisted upon before the order obtains immediate attention and delivery is hastened. As an example, something was recently called for to be used at a nearby camp, the producer being in Trenton, N. J. When a jobber, acting as the buyer for a contractor, asked when delivery could be made he was told that the merchandise in question could not be had under ninety days. Thereupon the manufacturer was promptly informed that the material was for the aviation camp at Mineola, N. Y. This altered the situation entirely. The order was filled at once and shipped the same day, reaching its destination in record time. In addition to priority of execution, the best prices are quoted on every description of government orders, and such delays as occur in their completion and delivery are charged up to interferences caused by labor agitations along obstructive lines.

Shipments of war material going abroad, to the British government, for instance, must arrange for cargo space

through the Minister of Munitions. When the goods arranged for are ready for delivery to an "Atlantic port," a cable advises the English official to this effect, a priority order for quick transportation is forthcoming through the War Industries Board to the railroads, and the entire shipment, whatever it may be, is aboard the outgoing vessel without a hitch from the factory to the sea.

SCANDINAVIA A MARKET FOR ELECTRIC RANGES

High Cost of Domestic Fuels Leads Northern European Nations to Make Inquiries Concerning American-Made Products

Recently there have come to this country a number of inquiries from Scandinavian countries regarding electric ranges. The scarcity of domestic fuels of all kinds has led these nations to look seriously to electricity as the most economical means for cooking. Already the electric furnace for industrial processes has there made great strides, and there seems every reason to believe that the domestic range will be very popular, provided that a supply can be obtained.

Because of large hydroelectric developments energy for this load can be had at a small expense. Once cultivated, this market will undoubtedly prove to be of considerable size to the American manufacturers of electric ranges, but the electric range industry in the United States is in such a condition at the present time that it hardly seems possible that much can be done in this direction. The demand in the United States for electric ranges in the past few years has grown very rapidly, and manufacturers now find difficulty in keeping up with the domestic demands. Besides, the supply of raw materials is in a very unsatisfactory position. Sheets are hard to obtain because of the government's need for sheet and for rolling mills to make tin plate.

METAL MARKET SITUATION

The Government Announces Resale Price on Copper —Tin High and Scarce

Arrangements have finally been completed whereby the wholesaler is permitted to resell such copper as he may desire, in less than carload lots only, to the consumer at a charge of not over 5 per cent of his original purchase price. This concession has been made by the War Industries Board, through the usual trade channels. As to its exact meaning the usual difference of opinion exists. This action was taken in recognition of the inability of small manufacturers to order in carload lots or more, which is the necessary condition for shipments to producers. On the basis of the new regulation, therefore, the small manufacturer can obtain his requirements in such quantities as may be necessary quickly, but at a slightly higher price than that of the larger manufacturers.

Tin is not only high, but scarce. One jobber in the market last week for 10,000 lb. was unable to find a seller. Lead is lower and brass higher; otherwise no changes have occurred either in the new or secondary metal markets.

NEW YORK METAL MARKET PRICES

	Nov. 19	Nov. 26
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	30.00 to 31.00*	28.00 to 30.00*
Lead, trust price	6.25	6.25
Nickel ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.97½ to 8.05	7.87½ to 7.97½
Tin, Straits	75.00	80.00
Aluminum, 98 to 99 per cent.	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire	22.50 to 23.00	22.50 to 23.00
Brass, heavy	14.50 to 16.00	14.50 to 16.50
Brass, light	10.50 to 11.50	10.50 to 11.50
Lead, heavy	5.25 to 5.75	5.50 to 5.87½
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

SALES of electrical merchandise, with a few exceptions in staples, represent, in all parts of the country, satisfactory totals. Some grave shortages in flashlight batteries, large-size motors, rubber-covered wire and conduit, with stocks heavily drawn upon, are reported in the Far West and elsewhere. Lamps continue in short supply pretty nearly everywhere, with indications of relief possibly after the first of the year. The bulk of trade, however, is in all household appliances, and this promises to increase, with stocks in fair condition. Price changes in nearly every line are not conspicuous.

With few exceptions collections are reported in a healthy state, with manufacturers and jobbers insisting on prompt settlements. Credits are held firm, and contractors of a speculative reputation are held to a strict accountability.

NEW YORK

Notwithstanding the drawbacks incident to the freight embargo in the New York territory, where it is making itself felt keenly on a number of electrical commodities, manufacturers, jobbers, distributers and dealers report satisfactory business. Of course, on seasonable goods this is more active than in the staple lines, wherein stocks are by no means so strong as could be wished. Deliveries continue uncertain and will in all probability remain so for weeks ahead. Prices and discounts vary slightly.

Collections are reported as very satisfactory, the trade in all its branches having evidently accepted the current high standard of liquidating indebtedness. Credits are firm, with the credit men holding a tight rein upon accommodations.

TURBINES, GENERATORS.—Up to the medium sizes turbines are on eight to twelve months' delivery. Prices are on the high level they have been for some time, with a bare possibility of a reduction, but no dating accompanies the prediction. Generators are likewise classified. The large-size deliveries are far distant—1920 and even later. Labor troubles at the factories have been adjusted and no further disturbances are anticipated.

HEATING APPLIANCES, UTENSILS, ETC.—Outside of heaters, of which jobbers and distributers do not always carry complete stocks, on account of the range of voltages and different demands, heating appliances, flatirons, toasters, grills, pads, etc., are in strong supply. Stocks of sewing machines are especially satisfactory, and orders are being filled on about an 80 per cent basis, which is reported as excellent, all things considered. As a jobber stated it, the manufacturers of all household and energy-consuming devices are sufficiently numerous to meet every reasonable demand by the trade, and therefore no uneasiness may be entertained in this territory on the score of shortage. Deliveries locally are hampered by truckage limitations. Shipments originating in the West are causing anxiety, and the seriousness of the situation is increasing rather than diminishing, with no relief in sight. In fact, deliveries are not expected to improve between now and the holidays. No price changes are looked for until the new year.

OUTLET BOXES.—Discounts on black boxes on orders under $10 list were advanced from 20 per cent to 25 per cent, and on orders running from $25 to $50 list from 30 per cent to 42 per cent. On galvanized, below $10 list, the discount was lowered from 25 to 20 per cent. The $25 to $50 list changed from 20 to 37 per cent.

PORCELAIN KNOBS, CLEATS.—Prices on porcelain knobs were advanced, with a marked shortage in the supply. This applies also to cleats, which have gone up, on the lowest range of prices that has been quoted, $4 and $5 per 1000.

ARMORED AND FLEXIBLE CONDUIT.—On account of the stagnation in building operations armored and flexible conduit is slow in moving. Stocks are strong; in fact, in most instances too strong.

SOCKETS.—There is no complaint of any curtailment of socket stocks as was intimated a few weeks ago. Jobbers' reports are to the effect that they are filling orders, perhaps not 100 per cent, but satisfactorily.

LAMPS.—On all sizes lamps are still reported as short. A leading middleman very frankly expressed the opinion that the supply from the factories was wholly inadequate.

COLLECTIONS AND CREDITS.—Collections remain in good shape, and dealers are meeting bills promptly. The tightening of credits has had a wholesome effect. This has been going on for some time, owing to abnormal conditions in selling and buying.

CHICAGO

With the contractors in the smaller cities in the territory business is spotty. Some have been resourceful enough to secure business out of the regular channels. They saw the decline in speculative building and took up factory work and farm lighting to fill in. The farm lighting is paying well where it is pushed because the high prices of farm produce have made the farmer spend freely. The factory work just now is largely reconstruction and rearrangement of equipment to permit handling government work. There is no doubt that the movement of goods is continuing more and more to incline toward consumption of a greater percentage for government work. The Christmas season is expected to reflect this situation in part.

CONDUIT.—Conditions in conduit delivery are getting worse in some quarters. Shipments in carload lots are especially hard to get. Smaller shipments, however, are being made from stock. Sizes of ¾ in. and larger appear to be giving the most trouble.

COPPER WIRE.—The prices on copper wire have not changed materially, although there has been some fluctuation up and down. Rubber-covered wire is still on a 34-cent to 35-cent base.

SOCKETS.—The report of shortage of sockets in the East has had no effect on Middle Western territory, and it is reported that there seems to be more likelihood of a shortage of socket orders than a shortage of sockets.

APPLIANCES.—A falling off in the purchase of percolators and toasters is noted by some electric-shop keepers. This is attributed to the fact that these devices are to some extent in the class of luxuries. Washing machines and vacuum cleaners, on the other hand, are reported to be going better than ever because of the fact that the labor-saving element enters more strongly into these devices.

INDUSTRIAL LIGHTING.—It is stated that prices of industrial lighting reflectors are hardly high enough to give a fair profit. These goods are moving well in spite of the fact that this time is somewhat between seasons.

CHRISTMAS TRADE.—The staple goods which constitute Christmas gifts are moving in good shape. Christmas-tree outfits have not commenced to move, but are expected to take on increased activity.

GLASSWARE.—Prices on all sorts of glassware, including glass insulators, seem to have an upward tendency, which has been somewhat accelerated by talk about the government commandeering the supply of natural gas in Ohio. Glassware is hard to get at present.

STORAGE BATTERIES.—It is understood that the decrease in the price of storage batteries about which rumors have been current in the trade in Chicago amounts to some 3½ to 5 per cent. One large user of vehicle batteries recently picked up 30,000 plates at a remarkably low figure.

SECOND-HAND MACHINERY.—One big manufacturer has announced that, owing to present abnormal conditions, the factory stock of induction motors is negligible and detail sheets showing the stocks will be dropped until their replacement is warranted. Second-hand machinery concerns are on this account getting orders from dealers for motors in large lots, showing that the need of the larger sizes of motors is great and price a secondary consideration, especially if immediate delivery can be given. On the smaller sizes of motors carried by second-hand dealers—that is, motors between 1 hp. and 5 hp.—prices have been somewhat reduced.

BOSTON

Intense activity continues in the electrical trade, government work underlying the market and profoundly influencing deliveries. It is understood that some orders still are to be placed for equipment for the great destroyer plant at Squantum, Mass., and also for the Watertown Arsenal, where guns are to be rushed to completion for General Pershing's army. The Squantum plant has been one-third completed, after only seven weeks' work, and the electrical trade deserves no little credit for its co-operation toward this achievement.

Collections are fairly good, but some complaint is heard regarding the slowness of contractors in meeting obligations. Labor troubles are on the whole less threatening than a week ago. The Western Electric Company's strike at Boston remains unsettled, but conferences are in progress with a view toward reaching a basis of agreement before a sympathetic strike of New England telephone operators and workers is declared.

Service flag stars are multiplying, and not a few contractors and jobbers are feeling the effects of the call to arms. Special emphasis is being laid upon the vital importance of the shipbuilding program in New England at this time, and in the supply of both labor and material the electrical industry in this section is doing much toward meeting the calls upon it in this respect. It is rumored that an increase in the price of porcelain will take effect in the early future. Railroad conditions are very unsatisfactory and are almost certain to be much worse with the first heavy snowfall. The trunk lines are choked with traffic, and embargoes are frequent enough to introduce serious time lags in many cases between factory and consignee.

RETAIL BUSINESS.—Dealers report great activity in small electrical commodities, over-the-counter sales being on a very healthy basis.

FIXTURES.—The annual spurt in fixture sales is under way, but the volume of trade is hardly up to last year's record as yet. Price conditions do not appear to be affecting this business as much as the absence of new building on a comprehensive scale.

LAMPS.—Miniature lamps are scarce and are likely to be until next June, when the effect of improved factory facilities will be felt. On standard tungsten lamps the shortage is reported to be somewhat abated, and some deliveries from stock are being made in moderate quantities. Large orders are not at present acceptable if they require special lamps or early deliveries in bulk. The market is in a better condition as regards deliveries than a year ago, and prices remain unchanged.

WIRE AND CABLE.—The government was in the New England market for 50,000 ft. of armored cable a few days ago. Jobbers are overstocked on BX and circular loom, and there appears not to be much of a market for this class of material, even in munitions work, at present. It would seem that emergency requirements in the construction field would be well met by calling upon existing large stocks instead of waiting for conduit. Smaller sizes of wire are showing improved deliveries, and some observers of the market look for a further reduction in prices early in 1918.

WIRING MATERIAL.—The market is very active here, and an advance in porcelain is said to be in contemplation, though representative dealers have received no formal advices so far as can be learned. Some outside construction will result from plans now under way for the better protection of the Boston waterfront.

FLOODLIGHTS.—These are moving fairly well, and Boston Harbor protective measures will soon lead to sales hitherto held in abeyance.

LABOR CONDITIONS.—Demands on the industrial labor market are very far-reaching here. In the near future there will be 20,000 men at work in the Boston district on the shipbuilding program. Difficulties at the Fore River plant will probably be settled this week. Thirty-five destroyers, costing about $1,500,000 each, are to be built in sixteen months at Squantum, and a large boiler plant for these craft is being erected near Providence, R. I. This work is of the first order of importance in the successful conduct of the war, and it naturally disturbs the labor supply in the electrical field. Readjustments are being made, however.

ATLANTA

Buying in almost all lines of the electrical field continues strong. Government buying makes for a very large volume of business. The stream of business in ordinary channels runs quite freely, considering that the government has preference in the matter of deliveries, but there is more or less uncertainty respecting the future trend of prices. Outlying districts that have been favored with good crops, zones in which cantonments have been established, shipbuilding centers and the Southeast in general continue to purchase in a way that suggests they are little affected by political or other factors that cause concern in the principal centers, and from these sections come reports of filling-in orders and fairly substantial buying for future delivery. Complaints regarding scarcity of labor, shortage of cars and paucity of materials are widespread.

LAMPS.—Estimates place sales in the South to date 40 per cent above last year, and the demand continues very strong. A great portion of this business is accredited to cantonments and shipbuilding plants, but, on the other hand, the call from industrial sources has also been very large. A number of textile mills are operating double shifts, and other industrial plants are running night and day. The government has practically standardized on the 25-watt and 40-watt sizes. The demand for carbon lamps shows a notable falling off, as industrial plants are also using more of the 40-watt type. This section is also developing into a good market for the "blue or daylight lamp," and a large number have been sold lately. There is a steadily growing demand for the 18-cp. automobile lamp. Shipments are coming in better now, and local stocks are in very good shape, considering the pressure, being 40 to 50 per cent of normal. A general lamp shortage is expected, owing to the abnormal demand and the inability of the manufacturers to cope with the situation. It is rumored that prices will be advanced about Jan. 1.

RECTIFIERS.—A strong demand exists, and comparatively good delivery is promised. Some substantial orders were placed this week.

CABINETS.—Reports from one manufacturer indicate a price advance of 5 per cent to take effect immediately.

STEEL PRODUCTS.—Information secured from an authentic source shows a slight shading in price, to the extent of 10 per cent, covering rigid conduit, stamped boxes and flexible armored cables, two-wire, No. 14, in the face of longer deliveries.

SEATTLE

Northwest dealers, in Seattle particularly, report business continuing good, with little or no changes over last week. Demands along several lines are still increasing, especially household appliances. Early holiday buying brings reports of satisfactory increases in trade, both wholesale and retail. Government buying for cantonment and navy yard work continues brisk. New cantonment contracts, in both Washington and Oregon, are swelling the volume of business and benefiting local dealers materially. Tacoma electrical dealers report very brisk business during the past month in sales to shipyards, industrial plants and for new buildings. Sales to shipyards and mills of electrical equipment in the Seattle territory are very satisfactory, although there has been no noticeable increase. No change in prices along any line the past week is noted.

The shortage of lamps still prevails and is becoming worse daily. There is also an extreme shortage in flashlight batteries, which is very unfortunate, as the demand is heavy. The shortage of motors of large-size, rubber-covered wire and conduit has not been lessened. The demand for wire and conduit is increasing. The demand for motors is light as compared with several months past. Shipments on the above-named goods are exceptionally hard to get.

Reports from various parts of the Northwest indicate an extreme shortage of labor in all lines of industry, the shortage being particularly exaggerated in the lumber mills and logging camps. A shortage of poles and cross-arms and of men to cut, prepare and handle them is causing inconvenience.

The transportation situation is becoming the subject of growing uneasiness and agitation. The number of unfilled requisitions for freight cars, after heavy declines between May 1 and Sept. 1, shows a large increase in spite of the vast augmentation of traffic. Local manufacturers believe the time may be almost here when it will be necessary to distinguish in railway transportation between things that are essential and those that are not essential. The expiration of government licenses for exporting merchandise has caused such a congestion of cars on Puget Sound that the railroads will be compelled to issue a general embargo unless relief can be had from some other direction.

Hopes of an immediate ending of the telephone strike in the Northwest vanished Nov. 25 when the Seattle strikers voted practically unanimously to reject the offer of settlement submitted by the federal mediation commission.

Projectors are moving well, although spasmodically. The new shipbuilding plants and industrial enterprises are making installations. The demand for projectors for advertising purposes shows a decrease, and stocks are ample. The demand for meters from Seattle and contiguous territory continues light. Tacoma reports a slight increase, deliveries are comparatively prompt and stocks are well filled. Fixtures are moving slowly, except in Tacoma, where there is considerable apartment house and residence building.

SAN FRANCISCO

A canvass of the electrical jobbers in the San Francisco territory fails to develop any complaints of delivery delays caused by the freight car shortage, and shows few in which the arrival was delayed by the generally congested freight situation or the priority of other freight. Prices have not fluctuated recently, and here and there is found a frank expression of the belief that prices have reached the top. This is not an altogether desirable condition, particularly as the prospects for the holiday trade are not now so bright as formerly. Retail stores are reporting a notable trend toward conservation and buying that is limited to necessities. Retailers are consequently not stocking far ahead.

Construction work on industrial plants engaged on government war orders continues to be prominent. The absence of building activity in the larger cities is now offset somewhat by the building in the country towns.

CREDITS AND COLLECTIONS.—Collections are a little harder than last month, as is usual in November, and credits are beginning to tighten. The prediction is that there will be a careful scrutiny of credits this winter. However, there have been no failures, and contractors and dealers particularly are paying up satisfactorily.

STORAGE BATTERIES AND FLASHLIGHTS.—This Christmas a holiday trade in flashlights easily 100 per cent above last year is expected. This is largely on account of supplies for the soldiers. Orders are coming from various cantonment supply centers in proportion to the number of men quartered there. The storage-battery demand is likewise very heavy. One San Francisco house has 800 battery orders pending the arrival of four carloads en route.

WEATHERPROOF AND RUBBER-COVERED WIRE.—The weatherproof wire situation is still uncertain. The price is lowering. Deliveries are slower, if anything. Stocks are very low. Rubber-covered wire stocks are in bad shape and deliveries are slow. Prices remain firm.

CONDUIT.—Conduit prices remain unchanged. Deliveries are slow and uncertain and stocks have been drawn down extremely low. This refers to galvanized conduit, which, on account of its resistance to salt-air conditions, is used almost to the exclusion of black conduit on this coast.

MOTORS.—Deliveries have improved slightly and one manufacturer has added sizes between 10 hp. and 15 hp. to the Coast stock, so that in these sizes immediate delivery is quoted. From 15 hp. upward deliveries vary from three or four weeks on orders which carry first priority certificates to five or six months on orders without certificates.

LAMPS.—Small retailers are now getting lamps for stocks of a week or ten days ahead. Hotels accustomed to buying a supply of 300 to 400 to keep on hand are now allowed about 100 at a time.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single Conductor

No. 14 Solid
Less than coil.....List to + 10%
Coil to 1000 ft.....10% to $59.17

No. 12 Solid
Less than coil.....List to + 10%
Coil to 1000 ft.....10% to $59.17

Twin-Conductor

No. 14 Solid
Less than coil.....List net to $105.00
Coil to 1000 ft.....$70.00 to 10%

No. 12 Solid
Less than coil.....List net to $135.00
Coil to 1000 ft.....—10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid
Less than coil.....List to +10%
Coil to 1000 ft.....List to —10%

No. 12 Solid
Less than coil.....+10%
Coil to 1000 ft.....—10%

Twin-Conductor

No. 14 Solid
Less than coil.....List to +10%
Coil to 1000 ft.....List to —10%

No. 12 Solid
Less than coil.....+10%
Coil to 1000 ft.....—10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....10% to list net
1/5 to std. pkg.....15% to 20%
Std. pkg.....28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....+20% to 12%
1/5 to std. pkg.....List to 20%
Std. pkg.....30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31 to .3175	.32 to .3275
Barrel lots	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. s. stp.	$75.00	$63.75 to $69.75
¾-in. d. stp.	75.00 to 82.50	68.25 to 75.50
½-in. s. stp.	100.00	85.00 to 93.00
½-in. d. stp.	100.00 to 110.50	91.00 to 100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.75
⅜-in. double strip	78.75	71.25-71.75
½-in. single strip	100.00	85.00
½-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.— $25.00-$55.00	$20.50-$24.75	$20.00-$22.00
¼-in.— $28.00-$60.00	$22.50-$27.00	$22.00-$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.— $36.67-$55.00	$27.50	$24.75
¼-in.— $30.00-$60.00	$30.00	$27.00

CONDUIT, COUPLINGS AND ELBOWS RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
¼	$0.03½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.60
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 5000 lb.	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	3.7%	6.7%
2500-5000 lb.	5.7%	8.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....$5.00 to $6.00
Discount.....25% to 30%

CHICAGO

List.....$5.00 to $6.00
Discount.....25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 *to* 125 *Volts*

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4¾ in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$36.56
Coil to 1000 ft.	27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.25 to $25.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list.	25% to 37%	20% to 32%
$10.00 to $50.00 list.	42% to 45%	37% to 40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 *and* 3 *Wire*

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $38.00
1/5 to std. pkg.	14.80 to 19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $20.54
1/5 to std. pkg.	14.80 to 19.24

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
		5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
		5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	List to —15%

SWITCHES, KNIFE

250-*Volt, Front Connections, No Fuse*

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List net to + 5%
$10 to $25 list	11%
$25 to $50 list	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	List to +5%
$10 to $25 list	List to —11%
$25 to $50 list	List to —14%
	Low Grade
Less than $10 list	List to —5%
$10 to $25 list	List to —16%
$25 to $50 list	List to —24%

SWITCHES, SNAP AND FLUSH

5-*Amp. and* 10-*Amp.*, 125-*Volt Snap Switches*

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-*Amp. 250-Volt Push-Button Switches*

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	List to + 10%
$2.00 to $10.00 list	10% to 20%	5% to 10%
$10.00 to $50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $7.50
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.44¼ to $0.65
No. 18, full spools	0.43¼ to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57½ to $0.65
No. 18, full spools	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	$15.00-$18.00	$13.00-$14.00	$11.25-$12.00
12	23.25- 27.09	21.30- 23.22	19.35- 20.85
10	32.40- 37.80	29.70- 32.40	27.00- 29.25
8	45.70- 53.34	41.90- 45.73	38.00- 41.38
6	72.40- 84.42	66.35- 72.35	60.30- 65.50

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$13.50	$12.00
12	27.36-27.37	23.41-27.37	21.88-23.46
10	38.15-38.25	32.40-32.72	29.97-30.60
8	53.83-54.27	46.14-46.43	42.29-43.42
6	72.40- 84.42	66.35- 72.40	60.30- 65.50

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$40.00 to $40.50
25 to 50 lb.	39.00 to 39.50
50 to 100 lb.	38.00 to 38.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Electrical Precipitation of Fine Particles

The Cottrell process, which, as is generally known, is an electrostatic method of precipitating the fine dust carried by gases, is being successfully used for smoke prevention, for suppressing the dust from cement mills, blast furnaces, converters and ore roasters, and for many similar purposes. Not only does it save the neighborhood of the plant in which it is used from the soot and dust nuisance, but it generally more than pays for its cost by the valuable materials that it reclaims.

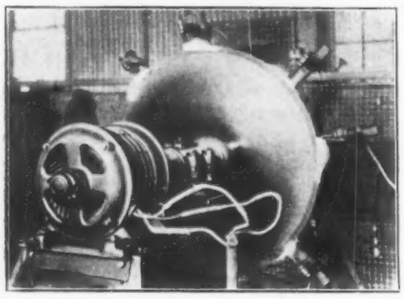


FIG. 1—TYPE OF GENERATOR USED

In operation the gases are passed through tubes or pipes, in the centers of which fine wires or chains are suspended. Between each tube and its central conductor a high static difference of potential is maintained by means of a unidirectional current of from 40,000 volts to 100,000 volts. Solid or liquid particles in the gases passing through these tubes receive a static charge of the same polarity as the central conductor, because the surface of the central conductor is much smaller than that of the tube and far greater ionization occurs at this point. The particles, therefore, are projected against the inner surface of the tube and are dislodged into hoppers below by jarring the tubes.

The high-voltage current for charging the treaters is derived from alternating current and is then rectified into unidirectional current by means of mechanical rectifiers or commutators. As the voltage at which the best results are obtained varies with the velocity, temperature and consistency of the gases and with the barometric pressure, arrangements must be made to vary this voltage by changing the low-voltage taps on the transformers for the coarse steps and by varying the voltage of the incoming alternating current for the intermediate steps. The alternating current may be supplied from a power line or separately.

Standard apparatus has been developed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., and is shown in the accompanying illustrations.

The unit generators are usually driven by motors so that motor-generator sets are generally supplied. The current generated is 60-cycle, single-phase and can be adjusted from 110 volts to 250 volts by means of a field rheostat. Standard capacities are 15, 25, 40 and 75 kva.

From the generators the current passes to the transformers. These are made in standard sizes of 15, 25, 40 and 75 kva. for 60 cycles and 10 kva. and 20 kva. for 25 cycles. Standard high-tension voltages are 40,000, 60,000 and 100,000. Each transformer has five standard low-voltage taps, giving 50, 62½, 75, 87½ and 100 per cent of full voltage respectively. Full rated capacity is obtainable on each tap. Careful protection against static surges has to be provided. Each of these transformers has a small oil-immersed choke coil mounted within the case between the end turns and the high-voltage windings, and transformers for over 50,000 volts have in addition choke coils mounted outside the case on each of the high-tension terminals. Condenser-type terminals are also used on transformers for 50,000 volts and over.

FIG. 2—15-KVA. TRANSFORMER 8 FT. HIGH

Red, White and Blue Lamp

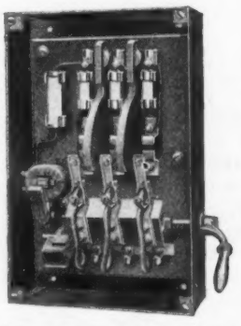
A Christmas-tree lamp which is tinted in the national colors is being manufactured by the Vacu-Rite Lamp Company, 361 West Superior Street, Chicago. The highest quality tungsten, the maker states, is used in its construction. The lamps have a 14-volt rating, eight of them being wired in series for use on 110-volt circuits.

Inclosed Starting Switch for Squirrel-Cage Motors

Inclosed starting switches that provide motors with protection against overload and against unexpected restarting after there has been an interruption in the circuit or failure of voltage have been developed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. They also insure safety to the operator under all conditions, because, as the manufacturer points out, he cannot touch a live part while operating the switch or when inspecting or renewing fuses. The sliding panel, which incloses the contacts and fuses, interlocks with the mechanism so that the switch cannot be closed, and the fuses are always dead when the sliding panel assumes the lowered position.

The fuses are not in circuit when starting, but are automatically included in the motor circuit when the starting handle reaches the running position. The fuses can, therefore, be of sufficiently low capacity to give proper protection to the motor windings. Failure of voltage causes the switch to open. Unexpected restarting, with the resultant possibility of injury to operator or machine driven, does not occur because the starting lever must be manipulated in order to put the motor into operation again.

The interior parts consist of three moving-contact fingers, which when the starting lever is moved to the extreme upward position make contact with three stationary contacts, connecting the motor directly to the line. After the motor is up to speed the hand is removed from the handle and the contact fingers slide into engagement with the running contacts, the change being made without opening the motor circuit.

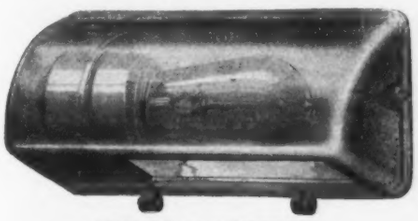


STARTING SWITCH WITH INCLOSED PANEL LOWERED

The rated capacity of this standard switch is 3-hp., 110 volts, or 5-hp., 220 volts.

Aisle Lighting Fixtures for Theaters

A special lighting fixture for illuminating theater aisles is one of the latest developments of the Brookins Company, Euclid Avenue and East Eighteenth Street, Cleveland, Ohio. A strong metal case is provided, which can be finished



FIXTURE IS DUSTPROOF

as desired. The interior of the case is finished in pure white for purposes of efficient reflection. A porcelain receptacle is used to carry the 10-watt tungsten lamp. The window is of double-strength ground glass, making the fixture dust-proof. With these fixtures installed in a motion-picture house all other lights may be extinguished.

Electric Refrigerating Machine

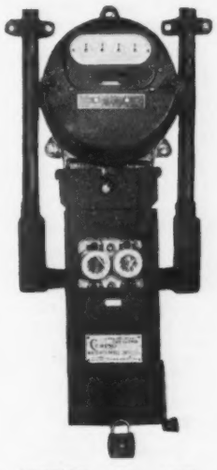
The "Williams" electric refrigerating equipment is designed primarily for household service and may be readily attached to any of the standard types of refrigerator. Provision is made for the production of a small amount of ice for the table and other uses. The cost per unit of refrigeration, the manufacturer points out, is considerably less than for an equivalent of ice. The machines, which are being made by the Electrical Refrigerating Company, Woolworth Building, New York City, are supplied in the following sizes: ¼ hp., ½ hp. and 1 hp. These sizes produce refrigerating effects equivalent to 150, 300 and 600 lb. (68.0, 136.1 and 272.2 kg.) of ice per day, respectively.

Magnetic Trouble Lamp

An electric lamp which operates from a 6-volt battery and embodies an electromagnet in the base, controlled by a switch which permits the lamp to be fastened to any iron or steel member of an automobile or support around a garage, is made by William J. Koenig of Brooklyn, N. Y. The device consists of a lamp socket with bulb incased in a nickel-plated holder and reflector and an electromagnet, incased in a steel shell, energized by the battery through the same connecting cable that feeds the bulb. A switch connected to the magnet permits the use or non-use of the magnet as desired. The lamp is operated in the same way as every other trouble lamp. A plug is provided at one end of 10 ft. (3 m.) of connecting cable so that a connection can be made in the dashboard of an automobile or any lamp socket of an automobile, motorcycle or motorboat. When used about a car, the lamp can be fastened to any convenient metal part and furnishes a steady light shielded by the reflector so as to throw the light where it is desired.

Fuse Protector and Service Switch

Externally operated switches are now being made by the Wadsworth Electric Manufacturing Company of Covington, Ky., that embody unique construction features. The inclosing box is made in parts which interlace in such a manner that when the cover is placed in position these parts are firmly locked without the aid of rivets or screws. The bottom and sides are formed in one continuous piece, while both ends, fuse holder, lid and meter adapter are detachable. This construction, the maker points out, permits the meter adapter to be placed either at the top or the bottom of the switch and so arranged that these adapters can be applied to any standard meter. This, it is claimed,



CAN BE APPLIED TO ANY STANDARD METER

is an advantage in this particular construction which makes for convenience of installation. To illustrate this, the maker cites the installation of three meters banked. In this case the bodies of the switch box are placed in position with conduit connections made from box to box, after which wiring is installed with uninterrupted access to wire gutter and terminal screws. Then the fuse holder is set in position at the top end of the box and the ends, meter adapter and lid are placed in position.

The switch employed is a standard single-knife design, operated from a handle on the outside. The handle is connected to a crank shaft with bearings on both sides of the box and connected to the switch by a cam on the bar. The lid is provided with a sliding shutter with brackets extending down to engage the switch-closing means in such a manner that closing the switch closes the fuse opening completely before contact is made by the switch to close the circuit. By this arrangement the fuses are accessible at all times and cannot be put in a position to expose a live connection.

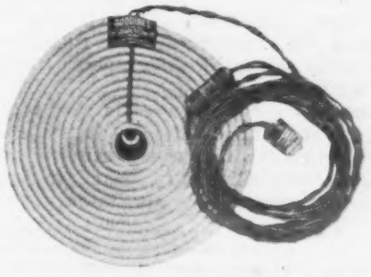
Sharpening Machine

The Henderson Machine Company of Cincinnati, Ohio, has developed the "Youngs" automatic razor-blade-sharpening machine, which is motor-operated. Dull blades of any make are put into the machine at one side by hand, the only manual operation, all others being automatic and dependent on a fractional-horsepower motor manufactured by the General Electric Company. The blades are conveyed across the machine during the honing and finishing processes, so that they receive the diagonal or barber's stroke at the rate of 60 to 120 edges per hour. Oilless bearings are used, and the drive is noiseless with self-adjusting friction drive. By means of a conveyor the need for an attendant is eliminated. The device is suitable for a window display.

Electric Heating Pad

The Goodwill Electric Company, 59 East Van Buren Street, Chicago, is offering an electric heating pad to the trade. This pad was originally designed for hospital service. The new pad for general use is a slight modification of one the company developed for the hospital field, though the principle of its construction is the same. The thermostat is mounted in the center of the pad and is contained in a sealed box 1.125 in. (3.2 cm.) in diameter and 0.25 in. (0.6 cm.) deep. It is composed of two U-shaped arms of half-hard brass and tempered steel, both of which are wound with a continuation of the German silver wire which forms the main heating element. Hence it is not dependent for its temperature on radiation, but heats up with the pad, both being always at the same temperature. The thermostat is adjusted through a slot in its container and has a range covering all points between 100 deg. Fahr. and 180 deg. Fahr. (37.8 deg. C. and 82.2 deg. C.).

Being designed to withstand hospital service, the pad is durable, but at the same time unusually light and flexible. Tendency to short-circuit is overcome by the helical construction, and the manufacturers claim that the current may be turned on when the pad is wet



WILL WITHSTAND ROUGH USAGE

without damage. It is made of two sizes, 10 in. (25.4 cm.) and 6 in. (15.24 cm.) in diameter. Both are equipped with cloth and rubber covers and 12 ft. (3.65 m.) of attachment cord with a separable connector near the pad to relieve possible strain.

Trade Notes

THE SPRAGUE ELECTRIC WORKS, Bloomfield, N. J., are planning for the construction of a large addition to their plant.

THE WESTON ELECTRICAL INSTRUMENT COMPANY, Newark, N. J., has increased its capital stock, by the issue of 5000 new shares of common stock, to $1,500,000.

THE MULTI REFILLABLE FUSE COMPANY, Chicago, has removed its office and salesrooms to 803 West Madison Street, where larger and more convenient quarters are secured.

THE STANDARD ELECTRIC TIME COMPANY, Springfield, Mass., will build a new three-sory addition to its plant, about 35 ft. by 105 ft., to cost $25,000. The contract for erection has been awarded.

WILLIAM S. BOYD, formerly assistant in the purchasing department of the Crucible Steel Company of America, Pittsburgh, Pa., is now purchasing agent of the Page Steel & Wire Company, Monessen, Pa.

THE AUSTIN COMPANY, Cleveland, Ohio, in order to centralize its business in the East, has removed the office at Bridgeport, Conn., to 217 Broadway, New York City. L. D. Stauffer will be in charge of sales, H. G. Phillips of engineering, and K. A. Pritchard of construction.

THE DEPARTMENT OF COMMERCE, Washington, D. C., has published "Customs Tariff of Chile" as No. 36 of the Tariff Series, compiled by L. Domeratzky. The chief difference between the new law and that of 1897, previously in force, is one of form, and the change is largely from the ad valorem to the specific system.

THE BLAKE ELECTRIC MANUFACTURING COMPANY, Boston, Mass., has enlarged its plant, following a reorganization of its business. A special department for winding and repairing alternating-current motors has been established apart from the direct-current service department, and the company's electrical construction department now occupies an entire floor at 1 Rowe's Wharf, Boston.

THE EDISON STORAGE BATTERY COMPANY'S New England sales office, of which George W. Holden is district manager, will shortly be moved from 236 State Street to 702 Beacon Street, Boston. The company will establish a service station about 100 ft. long by 35 ft. wide at its new location, including quarters for its sales staff. The company expects to be at its new address in about a week.

THE CONNECTICUT BRASS & MANUFACTURING CORPORATION, Waterbury, Conn., has been organized to acquire and consolidate the business of the Connecticut Brass Corporation of West Cheshire and the Pilling Brass Company, Waterbury. It will be the largest concern of its kind in the country. The production of the constituent companies in twelve months has increased 1000 per cent. The prospectus of the new corporation has just been distributed.

THE PHILADELPHIA STORAGE BATTERY COMPANY, Philadelphia, has opened a branch office and depot at 37 Spear Street, San Francisco, Cal. The company's first Pacific Coast branch was opened in Los Angeles a year ago. Arthur Affeld will have charge of the Los Angeles office and A. P. Clark will operate the San Francisco office. C. L. McWhorter, manager of the Pacific Coast division, will make his headquarters at the San Francisco office.

WILLIAM CRAMP & SONS SHIP & ENGINE COMPANY, Philadelphia, has purchased for $1,500,000 the property of the De La Vergne Machine Company, covering five and one-half acres in New York City. The plant is to construct marine steam engines and other work now being executed by the Cramp company for the United States government. No change will be made in the De La Vergne organization with the exception of a new board of directors.

CONDENSITE PATENT RECOGNITION.—Pending litigation between the Condensite Company of America and the General Bakelite Company has been terminated, and as a result of the settlement the General Bakelite Company agrees to recognize the validity of the Condensite (Aylsworth) patents, No. 1,065,495, dated June 24, 1913, and No. 1,137,374, dated April 27, 1915, and to pay substantial royalties thereunder. This recognition of the force and validity of the Condensite company's varnish patents by the General Bakelite Company is a confirmation of the Condensite company's claims for the broad scope and pioneer character of these patents. The Condensite company is advised that any phenolic condensation varnish, enamel, lacquer or cement making use of a double solvent falling within either description given below will be an infringement of one or other of the said patents, and the company intends to prosecute vigorously any and all infringements thereof. Users of phenolic varnishes, enamels, lacquers and cements are particularly cautioned not to deal in or make use of infringing products. These products are largely used in the electrical industry. The patents cover broadly varnishes, lacquers, enamels and cements in which a phenolic condensation product (such as condensite or bakelite) is combined with a double solvent of either of the following types: First, a readily volatile organic liquid and another organic liquid immiscible with and of a higher boiling point than water; second, a liquid oxygen compound of the aliphatic series and a compound of the benzine series soluble therein or a cyclic hydrocarbon.

New Incorporations

THE ROARING SPRING (PA.) LIGHT, HEAT & POWER COMPANY has been incorporated by I. E. Garver, A. L. Garver and E. G. Robb of Roaring Spring. The company is capitalized at $50,000.

THE UNIVERSAL SIGNAL COMPANY of St. Louis, Mo., has been incorporated by George A. Czibulka, A. C. Wirth and others to manufacture automobile signals. The company is capitalized at $27,000.

THE ECONOMY ELECTRIC COMPANY of Norfolk, Va., has been incorporated by Charles A. and E. R. Page of Norfolk and others. The company is capitalized at $50,000 and proposes to manufacture electrical supplies.

THE MONTGOMERY TRANSIT & LIGHT COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000. The incorporators are: J. J. Jolls, M. L. Horty and K. E. Langfield of Wilmington, Del.

THE BEAVER RIVER POWER & LIGHT COMPANY of Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $400,000, to generate and distribute electricity for lamps and motors.

L. ADLER & COMPANY of New Brunswick, N. J., have been incorporated by Louis P. Ruck, Robert Rosen of New Brunswick; Louis Adler and Annie Adler of Bound Brook, N. J. The company is capitalized at $25,000 and proposes to manufacture electrical fixtures.

THE NEWTON (IND.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $10,000, to install and operate an electric light and power plant in Newton. The incorporators are: James R. Campbell, Thomas Schultz and George F. Chamberlain.

THE KANT-MIS SPARK PLUG COMPANY of Green Bay, Wis., has been chartered with a capital stock of $10,000 to manufacture spark plugs and other gas-engine and automobile devices and accessories. The incorporators are: William C. Haslem, Bearl E. Calburn and J. Gilleaume.

THE RAILWAY & POWER ENGINEERING CORPORATION of Toronto, Ont., has been chartered by Theodore Maim, 55 Kingswood Road; Gerard Ruel, 127 Isabella Street; Frederick C. Allen and others. The company is capitalized at $50,000 and proposes to manufacture machinery, tools, etc.

THE ALPHA ELECTRIC & MANUFACTURING COMPANY of Warsaw, Ind., has been incorporated by Walter H. Stanley, Angus C. McDonald, George W. Polk, John William Scott and Bertram Shane. The company is capitalized at $50,000 and proposes to manufacture electrical and mechanical devices.

THE SNOWFLAKE & TAYLOR MILL COMPANY of Snowflake, Ariz., has been incorporated by A. Z. Palmer and J. J. Shumway of Taylor; Walter H. Denham of Shumway; John A. Freeman, Samuel F. Smith, Joseph W. Smith and W. H. Shumway of Snowflake. The company is capitalized at $50,000 and proposes to supply electricity in Snowflake, Taylor Mill and vicinity.

THE RURAL SERVICE COMPANY of Philadelphia, Pa., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000 to install and operate heating and lighting systems in many of the smaller towns in Delaware and Maryland. The incorporators are: Francis S. Brown of Philadelphia, Pa.; William G. Taylor, Townsend W. Miller, Robert Penington of Wilmington, Del., and Joseph P. Bryan of Dover, Del.

Trade Publications

RANGES. — The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared its catalog 8-D, descriptive of its automatic electric ranges.

FLASHERS. — The Reynolds Electric Company of Chicago is sending out a mailer entitled "How to Save Coal." This mailer describes the sign flasher made by this company.

CONNECTORS. — The Diamond Expansion Bolt Company of New York City has prepared a leaflet descriptive of its Diamond-strand connectors used with specially heavy three-bolt guy clamps.

FILM SERVICE. — The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared a booklet descriptive of its motion-picture, lantern-slide and lecture-bureau service.

INDUSTRIAL PRODUCTS.—The Nuttall Company of Pittsburgh, Pa., has prepared an illustrated bulletin descriptive of its industrial products. This book includes information on gears, expansion joints, flexible couplings and trolleys.

ELECTRICAL HOLIDAY SUGGESTIONS.—Julius Andrae & Sons Company of Milwaukee, Wis., has issued bulletin No 90, in which are listed many electrical holiday suggestions for Christmas, 1917. A dealers' price list is also included.

PUMPS AND RECEIVERS.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, has prepared a bulletin descriptive of its Deane automatic pumps and receivers, steam, electric, single, duplex and triplex types.

ENGINEERING DATA BOOK.—Ophüls-Hill & McCreery, Inc., 112 West Forty-second Street, New York City, has issued a data book for securing all data pertaining to plants and the operating conditions to make estimates on contemplated improvements.

WINDING MACHINES.—Ampudia & Cahill, Candler Building, New York City, have prepared an illustrated leaflet descriptive of a cable-winding machine. This machine does the winding on the ends of cables in the form required by both United States standards and foreign standards for aeroplane work.

LAMPS. — "How to Sell Mazda C-2 Lamps" is the title of a bulletin prepared by the National Lamp Works of General Electric Company of Cleveland, Ohio. The purpose of this book is to present clearly and concisely the important facts necessary to the successful merchandising of Mazda C-2 lamps, with examples of their application, supplying conclusive evidence of the reliability of claims for them.

TOOLS.—The Borden Company of Warren, Ohio, has just issued its 1918 catalog of "Beaver" die stocks and square-end pipe cutters. This catalog is said to be the finest tool catalog ever issued, and its attractive appearance indicates that no expense has been spared in securing the services of the best artists and printers. Several new "Beaver" tools are shown for the first time in this catalog—one of the most popular of these being the No. 3 "Beaver" junior ratchet die stock, which is built on the unit plan to thread pipe from ⅛ in. to 1 in., inclusive.

OUTDOOR CABLE TERMINALS.—A revised bulletin on type D. O. A. outdoor cable terminals has just been issued by the Standard Underground Cable Company of Pittsburgh, Pa., in which several new types of terminals are described and listed. Among these are the protected disconnection terminal, pipe-top terminal and borehole terminal. The bulletin gives tables of working voltages and sizes of conductors for which terminals of certain dimensions and weights are required; also instructions for ordering, installing, etc. A copy will be sent on request.

MOTOR TRUCKS OF AMERICA.—Announcement is made that the 1918 edition of "Motor Trucks of America," of which S. V. Norton, manager of truck tire sales of the B. F. Goodrich Rubber Company, is the author, will be ready for distribution on Jan. 1. The book, consisting of 200 pages of reading matter, illustrations and specifications, is the sixth to be issued in as many years. It is hand-sewn and of heavy binding. Complete specifications of nearly 150 of the leading gas-driven and electrically driven motor trucks are contained in the volume. These details are absolutely dependable as the approval of each truck manufacturer is obtained before specifications of his model are inserted.

New England States

BURLINGTON, VT.—The Winooski Valley Power Company has petitioned the Public Service Commission for permission to increase its bonded indebtedness to more than a million dollars, the proceeds to be used for further extensions. The present capacity of the plant at Essex Junction is 10,000 hp., which is leased to the Burlington Light & Power Company.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 10, for construction of a garage, including plumbing, lighting and heating systems at the naval training station at Newport, R. I. Drawings and specifications (No. 2688) may be obtained upon application to the above bureau or to the commandant of the naval station named.

NEW LONDON, CONN.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 10, for furnishing and installing on the runway railways one 5-ton, three-motor bridge crane, one 2-ton hand-operated bridge crane and one 1-ton hand-operated bridge crane in the machine shop at the submarine base at New London, Conn. Drawings and specifications (No. 2701) may be obtained on application to the bureau or to the commandant of the naval station named.

Middle Atlantic States

ASTORIA, N. Y.—The Astoria Heat, Light & Power Company is contemplating the erection of a grinding mill at its plant along the river at Casino Beach, to cost about $25,000.

ASTORIA, N. Y.—The Astoria Consumers' Ice Company is planning to erect an ice plant, 90 ft. by 200 ft., on Seventeenth Avenue, south of Flushing Avenue, to cost about $60,000.

AUBURN, N. Y.—The special committee appointed to investigate the feasibility of establishing a municipal electric-light plant has recommended that steps be taken at once for the project and that the engineer who made a survey of the lighting proposition a year ago be engaged to prepare plans for the proposed new plant.

CLYMER, N. Y.—The Public Service Commission has granted the town of Clymer permission to establish and operate a municipal electric-light plant.

COBLESKILL, N. Y.—The installation of a municipal electric-light plant in Cobleskill is reported to be under consideration.

NEW PALTZ, N. Y.—Bids will be received by Dr. Thomas E. Finegan, deputy commissioner of education, Education Building, Albany, N. Y., until Dec. 17, for construction, including heating, sanitary and electric work, of addition to the State Normal School at New Paltz. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany. Drawings and specifications may be consulted at the State Normal School, New Paltz, and at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York City.

TROY, N. Y.—Plans are being considered for the erection of an addition to the laboratory of the Rensselaer Polytechnic Institute, Troy, to cost about $100,000.

WALDEN, N. Y.—The capital stock of the Wallkill Valley Electric Light & Power Company has been increased from $16,000 to $30,000, the proceeds to be used for extensions.

ASBURY PARK, N. J.—Bids will be received by the Board of Commissioners of the city of Asbury Park until Dec. 10 for electric work in connection with alterations to the Municipal Building, at the corner of Bond Street and Mattison Avenue. Plans and specifications may be obtained from Ernest A. Arend, architect, Kinmouth Building, Asbury Park, or 105 West Fortieth Street, New York, N. Y. Harry B. White is city clerk.

BORDENTOWN, N. J.—Plans have been prepared for improvements to the electric street-lighting system. It is proposed to use lamps of greater candlepower and install larger units in the business section of the city.

EAST ORANGE, N. J.—The Sprague Electric Company is planning to build a power plant at its works, to cost about $20,000. The company manufactures motors.

ELIZABETH, N. J.—Owing to conditions brought about by the war the Board of Public Works has sanctioned an agreement with the Public Service Corporation and the United Electric Company of New Jersey which will release them from the necessity of expending $25,000 this year for underground work in Elizabeth.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

JERSEY CITY, N. J.—The capital stock of the Municipal Light & Power Company has been increased from $200,000 to $4,000,000.

NEWARK, N. J.—Plans are being prepared by the Rubber & Celluloid Products Company for improvements in its boiler house on Irving Place.

WESTFIELD, N. J.—Plans are being considered by the Park Commission for the installation of an electric-lighting system through Lake Park. Ornamental standards will be used.

EASTON, PA.—Arrangements are being made by the Pennsylvania Utilities Company to provide for an electric railway connection from its Dock Street plant to the coal-storage and ash-dumping grounds. The company has recently completed the installation of a new ash and coal-handling equipment.

HAZLETON, PA.—Plans are being considered for the installation of a new type of electric lamp for the West Diamond Avenue Parkway.

LANCASTER, PA.—The Conestoga Traction Company is contemplating extensions and improvements to its Engleside power plant, to cost about $100,000. The plans provide for the installation of considerable electrical equipment.

PHILADELPHIA, PA.—The American Railways Company has been compelled to again place in operation the old electric plants in both Salem and Bridgeton, owing to the failure of securing sufficient energy from the plant at Wilmington, across the Delaware River.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 10, for furnishing and installing on the runway rails two 6-ton, two-trolley, five-motor bridge traveling cranes and one 3-ton swinging jib crane in the new galvanizing plant at the United States Navy Yard, Philadelphia, Pa. Drawings and specifications (No. 2699) may be obtained on application to the above bureau or to the commandant of the navy yard named.

PHILADELPHIA, PA.—Bids will be received by the Department of City Transit until Dec. 4 for the following work appurtenant to the Frankford Elevated Railway: Contract (No. 539), plumbing installation on station buildings at Orthodox-Margaret Streets and at Ruan-Church Streets; Contract (No. 540), electrical installations in stations buildings at Orthodox-Margaret Streets and at Ruan-Church Streets. Copies of plans and specifications may be obtained upon deposit of $10, to be refunded upon return of plans.

PITTSBURGH, PA.—The City Council has adopted an ordinance authorizing a contract with the Duquesne Light Company to light the first twenty wards of the city with electricity for a period of ten years.

PITTSBURGH, PA.—Owing to the great demand for electric power service the West Penn Power Company has been compelled to refuse to connect new power consumers. Many of the regular consumers have arranged to use power at night. The breakdown of the large new plant at Windsor, W. Va., has handicapped the company. Repairs cannot be completed for several weeks.

READING, PA.—Work has begun on the construction of a large addition to the West Reading plant of the Metropolitan Edison Electric Company, which will double the output of the plant. Contracts have been placed by the company for a new 25,000-kw. turbine and two 1000-hp. boilers.

SUNBURY, PA.—The Borough Council has appropriated $600 to be used to secure estimates of the probable cost of establishing a municipal electric-light plant in Sunbury. Electrical service is now furnished by the Northumberland County Gas & Electric Company of Sunbury.

WILKES-BARRE, PA.—The Lehigh & Wilkes-Barre Coal Company is building a new power house at the Green Mountain colliery.

BALTIMORE, MD.—Preparations are being made by the Reus Brothers Company, 146 West Mount Royal Avenue, to enlarge its plant. The company has acquired a site in the rear of its present building on which it will erect a machine shop. It is now erecting a special ignition laboratory for repair and maintenance of electrical equipment for automobiles and rebuilding and recharging of storage batteries. The proposed improvements will add 10,000 sq. ft. to the machine and ignition department.

GLENARM, MD.—The machine shop, boiler shop, and office building of the F. X. Hooper Company of Glenarm was recently destroyed by fire.

CHARLESTON, W. VA.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of an electric power distribution system at the naval projectile plant, at $13,500.

HUNTINGDON, W. VA.—Plans are being considered for a complete lighting system for the parkway.

LEWISBURG, W. VA.—A company has been organized by local interests to take over the property of the old Lewisburg & Ronceverte Electric Railway Company and complete the railway into Lewisburg.

North Central States

DETROIT, MICH.—The County Commissioners of Wayne County are considering the installation of electric elevators to replace the steam-driven lifts now in use. The installation of an independent light and power plant to supply electricity for lamps and motors for the county building is also under consideration.

EATON RAPIDS, MICH.—At an election to be held Dec. 3 the proposal to issue $30,000 in bonds, the proceeds to be used for the purchase of water powers at Eaton Rapids and Smithville, on the Grand River, 2 miles distant, will be submitted to the voters.

AKRON, OHIO.—Bids will be received at the office of C. F. Beck, director of public service, Akron, Ohio, until Dec. 6 for furnishing motor-driven centrifugal pumps as follows: (1) Two horizontal centrifugal pumps, normal capacity 1000 gal. per minute against 100 ft. total head, directly connected to motor; (2) one horizontal centrifugal pump, normal capacity 1000 gal. per minute against 50 ft. total head, directly connected to electric motor. Specifications may be seen at the office of the director or copies may be obtained from the Engineering Department, Water Works Office, 102 East Mill Street, Akron. G. G. Dixon is engineer.

CLEVELAND, OHIO.—The Public Utilities Commission of Ohio has given its approval to the application of the American Gas & Electric Company and the Lake Shore Electric Railway Company to purchase the hydroelectric plant of the Ohio State Power Company, located on the Sandusky River, for $120,000. The plant is to be used owing to the shortage of coal.

DE GRAFF, OHIO.—At an election held recently the proposal to sell the municipal electric-light plant was carried.

EAST LIVERPOOL, OHIO.—The City Council has decided to postpone the installation of the new street-lighting system for another year at least, and has authorized a continuance of the present lighting system with the Ohio River Power Company for a period of one year.

MANSFIELD, OHIO.—The property of the Mansfield Electric Railway, Light & Power Company has been taken over by the Mansfield Electric Light & Power Company, a subsidiary of the Cities Service Company. The power plant of the former company will be closed down and energy for operating line will be obtained from the Melco plant (recently completed) of the latter company.

PORTSMOUTH, OHIO.—The general plan of the Portsmouth Street Railroad & Light Company for extending its line to Nauvoo, West Side, has been approved by the directors of the Board of Trade of Portsmouth.

LOUISVILLE, KY.—Contract has been awarded by the government for the construction of a power house at Lock No. 41, Ohio River, to the National Concrete Construction Company of Louisville, at $7.691.

GARY, IND.—The substation of the Gary & Interurban Railroad Company in West Gary was recently destroyed by fire, causing a loss of about $35,000.

NEWTON, IND.—The Newton Electric Light Company, recently incorporated with a capital stock of $10,000, is contemplating installing an electric-light and power plant. James R. Campbell, Thomas Schultz and George F. Chamberlain are directors.

BLOOMINGTON, ILL.—The Bloomington & Normal Railway & Light Company has applied to the Illinois Public Utilities Commission for permission to issue $53,000 in capital stock.

CHICAGO, ILL.—The Apex Electric Manufacturing Company, Fifty-ninth Street,

Chicago, manufacturer of electrical supplies, is contemplating building an addition to its plant, about 25 ft. by 50 ft., one story.

APPLETON, WIS.—The trustees of Lawrence College are considering the purchase of two or three large boilers for the college heating plant.

CLINTONVILLE, WIS.—The Topp-Stewart Tractor Company is considering the construction of a new hydroelectric power plant near Clintonville. As yet nothing definite has been decided upon. A. H. Mayhew is secretary.

MILWAUKEE, WIS.—The Pawling & Harnischfeger Company, Thirty-eighth and National Avenues, is building a large power house, to cost about $25,000. The company manufactures traveling and other hoisting cranes.

SUPERIOR, WIS.—The Globe Shipbuilding Company, which is adding an area of 400 ft. by 1500 ft., to its yards, is planning to install three electrically operated travelling cranes.

SIOUX CITY, IOWA.—The contract for lighting fixtures for the new county court house has been awarded to the McGraw Company, at $16,000.

OZARK, MO.—Steps have been taken by residents of Ozark to prevent the sale of the local electric-light plant, which will soon take place. It is proposed to organize a company to take over the property. John W. Robertson, president of the Business Men's League, is interested.

ST. CHARLES, MO.—The installation of an ornamental lighting system in St. Charles is under consideration. Three ornamental, single lamp, standards have been erected in different parts of the city by the American Light & Power Company for experimental purposes.

SOUTHWEST, MO. — Steps have been taken to organize a company to establish a municipal electric-light plant in Southwest.

PENDER, NEB.—The contract for improvements to the municipal electric-light plant has been awarded to the Wright Electrical Construction Company of Fremont.

AGENDA, KAN.—At an election held recently bonds for the installation of an electric-light plant in Agenda were authorized.

CHANUTE, KAN. — Improvements including the installation of new boilers are being made to the municipal electric-lighting plant. The cost is estimated at about $20,000.

CUBA, KAN.—At an election held recently the proposal to issue bonds for the installation of an electric-lighting system in Cuba was carried.

ELLSWORTH, KAN.—Work has begun on the construction of a new building for the local electric-light plant. New equipment, including generating machinery, will be installed.

INDEPENDENCE, KAN.—All bids for the installation of the proposed ornamental lighting system have been rejected by the City Commissioners. It is expected that new bids will be asked for.

JENNINGS, KAN.—The local electric light plant, it is reported, has been sold to T. A. Vonada.

LURAY, KAN.—At an election to be held Dec. 14 the proposal to purchase the local electric-light plant, owned by M. L. Britton, to be owned and operated by the municipality will be submitted to the voters.

MERRIAM, KAN.—The power house of the Hocker interurban railway at Merriam was recently destroyed by fire, caused by an explosion. Arrangements have been made with the Kansas City Railways Company to furnish electricity to operate the line.

NEWTON, KAN.—The installation of an ornamental lighting system, covering twelve blocks, is under consideration. The Kansas Gas & Electric Company of Wichita furnishes electrical service in Newton.

WICHITA, KAN.—The Wichita Railroad & Light Company will begin work at once on the construction of an extension to the Orient shops.

WICHITA, KAN. — The Public Utilities Commission has granted the Kansas Gas & Electric Company of Wichita permission to sell $460,000 in bonds, the proceeds to be used for extensions and improvements to its system.

Southern States

BURLINGTON, N. C.—The Piedmont Railway & Electric Company has increased its capital stock to $1,000,000, and has changed its name to the Piedmont Power & Light Company.

MOBILE, ALA.—Work will begin immediately on the construction of the large shipyard for the United States Steel Corporation on the land recently purchased north of Mobile. Ten shipways will be laid down and wharves of suitable capacity for fitting out the ships will be built. A large power plant, boiler shop, joiner shop, machine shop, steel metal shop, forge shop, storehouse and main office will be erected. Two large villages have been laid out, one for whites, and the other for colored workmen. Electric-lighting and street railway service will be provided. The Mobile company will be known as the Chickasaw Shipbuilding Company. George Gordon Crawford, president of the Tennessee Coal, Iron & Railroad Company, will be president of the Chickasaw company.

ASHDOWN, ARK.—The Ashdown Light & Ice Company, recently incorporated with a capital stock of $50,000, it is understood, will take over the property of the Ashdown Ice, Light & Power Company, recently purchased by M. B. Morgan of Little Rock. The electric-light plant and ice factory, it is reported, will be enlarged.

KENSETT, ARK.—The City Council has granted a franchise to Dr. E. C. Hardin to furnish electricity for lamps and motors in Kensett for a period of 25 years.

SEMINOLE, OKLA.—At an election to be held Dec. 14 the proposal to issue $5,000 in bonds for the installation of an electric-light plant will be submitted to the voters.

BEAUMONT, TEX. — Plans are being prepared by the Crystal Ice Company for improvements to its plant, including extensions to the ice-storage house, the installation of ice-manufacturing machinery to increase the output to 120 tons daily; also remodeling the interior of buildings and the installation of equipment to provide three methods of motive power, steam, oil and electricity. The cost of the work is estimated at $20,000.

DALLAS, TEX.—To insure an adequate supply of power during the peak load the electric transmission lines of the Dallas Power & Light Company and the Texas Power & Light Company will be connected at Norwood and Trinity Heights in Dallas. This arrangement, it is understood, will require the erection of a high-tension transmission line, 7 miles long, costing approximately $250,000. F. R. Slater is vice-president and general manager of the Texas Power & Light Company.

DALLAS, TEX. — Within five years the Dallas Power & Light Company will expend approximately $2,834,500 for improvements and extensions to its service. The plans provide for the erection of four substations for the distribution of energy, which will be the first work to be done. The first station will be erected in the downtown section, located near the Interurban Building, at a cost of about $575,000; a second station to serve Oak Cliff, costing about $177,400, will be erected near the Oak Cliff car barns; a third station will be erected on Peak Street, probably near the car barns, at a cost of about $181,300; it is proposed to build another station in East Dallas, the cost of which has not been given out. The underground system calls for an expenditure of about $918,200. Extensions and improvements to the generating and transmission systems will cost about $729,000. About $253,600, it is estimated, will be required for extensions and improvements to the overhead system, including street-lighting.

HOUSTON, TEX.—The Petroleum Refining Company is planning to erect a large machine shop, carpenter shop and to install a steam-driven plant in connection with its new oil refinery in Houston. Electrically operated pumps will be used for pumping oil into the steel tanks.

SAN ANGELO, TEX.—Plans have been approved by the San Angelo Water, Light & Power Company for the construction of a reinforced-concrete dam across the South Concho River, a few miles south of here, for the purpose of increasing the water supply of the city. The dam will be approximately 225 ft. long, 15 ft. high and above low water mark, 10 ft. wide at base and 4 ft. wide at the top. The company will also install additional machinery in its water, light and power plant.

SAN ANTONIO, TEX.—The Missouri, Kansas & Texas Railroad Company, it is reported, is planning to erect an ice and cold storage plant at San Antonio, to cost about $100,000.

VICTORIA, TEX.—The city of Victoria has engaged A. Garcia of the Independent Electric Light Company to prepare plans for an ornamental-lighting system and underground conduit system in connection with the proposed municipal electric-light plant. Bonds to the amount of $40,000 have been voted for installation of plant.

WACO, TEX. — Extensive improvements are contemplated by the Big Four Ice Company involving an expenditure of about $50,000. The work will include the installation of a 50-ton electrically-driven ice machine, the erection of a 3000-ton ice-storage house, and the installation of an automatic stoker to be used in handling lignite coal. Jacob J. Schrade, chief engineer, will have supervision of the work.

Pacific and Mountain States

CENTRALIA, WASH.—The North Coast Power Company of Portland, Ore., has petitioned the Commissioners of Lewis County for permission to erect and operate electric transmission lines of the roads in Lewis County. A line to Forest over the Pacific Highway is one of the extensions contemplated by the company.

GRAND MOUND, WASH.—The State Board of Control has called for bids for the construction of another cottage and power plant for the State School at Grand Mound. The cost of the cottage is estimated at $40,000, and the power plant at $30,000.

SEATTLE, WASH.—Plans have been prepared for the construction of a boiler house, 64 ft. by 160 ft., at the plant of the Seattle Boiler Works, to cost about $12,000.

SEATTLE, WASH.—Preliminary work is under way for the construction of a shipbuilding plant for the Erickson Engineering Company of Seattle, which has received contracts from the government for ten 9500-ton steel ships, involving an expenditure of $20,000,000. The plans provide for six shipways, a boiler shop, plate shed, machine and blacksmith shops. C. J. Erickson is president.

SKYKOMISH, WASH.—The Town Council has accepted the bid of the State Board of Finance for the $7,000 bond issue, the proceeds to be used to establish a municipal electric-light and power plant.

SPOKANE, WASH.—Residents on Post Street have filed a petition with Commissioner Fassett for the installation of an ornamental lighting system on Post Street, extending from the bridge to Third Avenue, similar to that in use on the east and west downtown streets.

STAYTON, ORE.—The City Council has granted a franchise for the construction of a new railway in Stayton. An electric power right for a period of 50 years was also given at the same time. The proposed railway, it is said, will be operated by steam for a time, but later will be equipped for electrical operation. Mr. Lynott is interested in the project.

BISHOP, CAL.—The Railroad Commission has extended the time in which the Bishop Light & Power Company may complete its reconstruction work—one-half to be completed before Dec. 31, 1917, and the entire work before June 30, 1918.

CLOVIS, CAL.—The Fresno Flume & Lumber Company has filed notice of application for 200 cu. ft. per second of the waters of Dinkey Creek, tributary of Kings River, for power purposes. The plans provide for a main ditch, tunnel and pipe line 4½ miles long, and the storage of 25,000 acre feet of water. The company has also filed an application for 400 cu. ft. per second of water in Big Creek, also tributary of Kings River, the water to be used in connection with the above power project. The main ditch and pipe line in the latter is given as 8 miles in length.

HOLTVILLE, CAL.—The Railroad Commission has extended the time in which the Holton Power Company may complete its work. At least half of the reconstruction work must be completed before Dec. 31, 1917, and the entire work before Dec. 31, 1918.

MIDDLETOWN, CAL.—Application has been made to the State Water Commission by Paul J. Stuparich of Middletown for permission to use 8 in. of water from Hickmott Creek in Lake County, to generate electricity for domestic use.

RIVERSIDE, CAL.—The Railroad Commission has extended the time in which the Southern Sierras Power Company may complete its reconstruction work. One third to be completed before Dec. 31, 1917, two-thirds before Dec. 31, 1918, and the entire work before June 30, 1919.

SAN FRANCISCO, CAL.—The Great Western Power Company has filed an amended application with the State Railroad Commission, asking for authority to use $3,000,000 derived from the sale of $4,998,000 in capital stock of the City Electric Company for reimbursing in part its treasury for expenditures between June 1, 1915, and Sept. 30, 1917, and for additions and betterments to its system.

TAYLORSVILLE, CAL. — The Great Western Power Company of San Francisco, has been granted a franchise to operate in certain portions of Plumas County. This franchise will allow the company to operate

in the town of Taylorsville, which has requested the company to furnish electrical service.

VALLEJO, CAL.—The Santa Rosa Vallejo Tanning Company has been granted a permit to erect a boiler house at the corner of Sixth and Rice Streets in connection with its proposed new power plant in North Vallejo.

ALBUQUERQUE, N. M. — Plans have been prepared, it is reported, by Trost & Trost of El Paso, for the erection of a hotel, 80 ft. by 150 ft., five stories, for Edwardo Otero of Los Lunas, N. M., to cost about $175,000. The plans provide for an electric power plant, to cost about $25,000; electric elevators, refrigerating system, vapor and steam heat, etc. Bids, it is understood, will be opened about Jan. 1.

Canada

LETHBRIDGE, ALTA.—The installation of additional equipment in the municipal electric-light plant, to cost about $65,000, is under consideration by the City Council.

SOUTH VANCOUVER, B. C.—The City Council is considering the installation of a 75-hp., 2200-volt motor in the city lighting plant.

TORONTO, ONT.—Plans are being prepared by the Hydro-Electric Power Commission of Eugenia for extensions to its power plant, to cost about $75,000.

TORONTO, ONT.—The Dunlop Tire & Rubber Company, 244 Booth Avenue, Toronto, is contemplating building an addition to its power plant, to cost about $5,500.

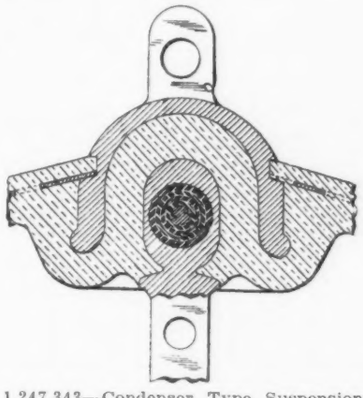
Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until Dec. 17, for furnishing steel reinforcing bars, electric cable and wire, transformers, electric meters, panelboards, electric fittings and fixtures, copper bussing, cable grips, cable jacks, ground clamps, fiber rod, fiber sheet, fish paper, rubber sheet, linen tape, insulating compound, mica, wood molding, brass chain, tank indicator, etc. Blank and general information relating to this circular (No. 1188) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,246,831. BRAKE; Frank W. Adsit, Chicago, Ill. App. filed June 17, 1916. Vehicle.

1,246,845. ELECTRIC-CIRCUIT-MAKING DEVICE; Reuben B. Benjamin, Chicago, Ill. App. filed April 19, 1912. Applicable to attachment plugs of the kind generally known as separable.

1,246,846. ELECTRICAL RECEPTACLE; Reuben B. Benjamin, Chicago, Ill. App. filed Jan. 27, 1916. Improved means for retaining a lamp base in place within receptacle.



1,247,343—Condenser Type Suspension Insulator

1,246,853. TAPER-CHARGE CURRENT REGULATOR; William L. Bliss, Niagara Falls, N. Y. App. filed April 6, 1917. Improved regulator for preventing the current delivered by a generator from increasing beyond a predetermined value until the storage battery connected therewith has been charged to a predetermined voltage.

1,246,854. STOP-CHARGE CURRENT REGULATOR; William L. Bliss, Niagara Falls, N. Y. App. filed April 6, 1917. Provides a regulator which will discontinue the battery-charging current after the battery voltage has risen a predetermined amount and which will be sensitive and positive in operation.

1,246,855. BATTERY CHARGING SYSTEM; William L. Bliss, Niagara Falls, N. Y. App. filed April 6, 1917. Provides an improved regulator for controlling the charging rate of storage batteries.

1,246,894. ELEVATOR-CONTROL LOCK; Edward L. Dunn, Worcester, Mass. App. filed Dec. 29, 1915. Improvements.

1,246,895. PHONOGRAPH TRANSMITTER; Henry C. Egerton, Passaic, N. J. App. filed Nov. 25, 1914. For transmitting to a circuit the vibrations of a phonograph record.

1,246,927. THERMO-ELECTRIC REGULATOR; Lee P. Hynes, Chicago, Ill. App. filed June 7, 1915. Regulating the electric heating apparatus of a car.

1,246,964. ELECTRIC CABLE; Charles W. Lowe, Jersey City, N. J. App. filed Feb. 17, 1917. Applies particularly to moisture-proof cases for inclosing electrical apparatus which is adapted to be connected into submarine cables.

1,246,970. CONNECTION SLEEVE FOR CABLES; James T. Madigan, Colorado Springs, Col. App. filed Nov. 29, 1916. Employed in connection with telephones.

1,247,009. RHEOSTAT; Thomas Rhodus, Chicago, Ill. App. filed June 23, 1917. Adjustable.

1,247,022. BATTERY; Frank B. Smith, Malden, Mass. App. filed May 1, 1917. Used by physicians.

1,247,026. INCANDESCENT-LAMP SOCKET; Martin V. Smith, Hartford, Conn. App. filed July 26, 1916. Improvements.

Record of Electrical Patents

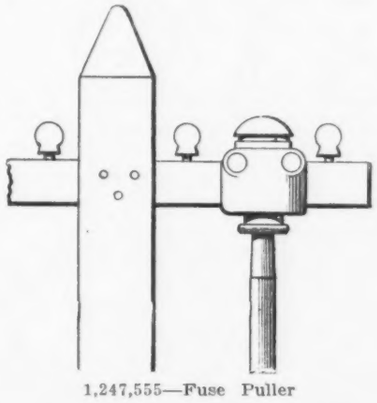
Notes on United States Patents issued on November 20, 1917

1,247,027. VACCUM REGULATION; Homer C. Snook, Cynwyd, and Edwin W. Kelly, Philadelphia, Pa. App. filed June 11, 1915. Relates to means for regulating the degree of vacuum of an X-ray tube or other vacuum tube.

1,247,041. AUTOMATIC CUT-OUT SWITCH; Edward Waigand and Benjamin Waigand, Nampa, Idaho. App. filed Nov. 9, 1916. Fuse cut-outs used in connection with three-phase circuits.

1,247,042. SUPPORTING FRAME FOR ELECTRIC SWITCHES; Cassius M. Walker, Pueblo, Col. App. filed Feb. 26, 1912. Adapted to contain and retain the several parts thereof in position to be included within a containing box.

1,247,068. FILAMENT; Burnie L. Benbow, Cleveland, Ohio. App. filed Oct. 4, 1913. Tungsten.



1,247,555—Fuse Puller

1,247,123. PLATE GUARD FOR SECONDARY BATTERIES; Joseph O. Luthy, San Antonio, Tex. App. filed April 16, 1917. Relates to guard sheaths or envelopes for secondary battery plates.

1,247,125. ARMORED CONDUCTOR; Charles P. Madsen, Chicago, Ill. App. filed Sept. 6, 1913. Adapted for high-temperature electric heater service.

1,247,127. PROTECTION OF TRANSMISSION SYSTEMS; Richard H. Marvin, Schenectady, N. Y. App. filed April 8, 1914. From arcing or permanent grounds.

1,247,154. ILLUMINATED LEVEL; William H. Robertson, Brewster, N. Y. App. filed May 3, 1917. Improvements.

1,247,180. ELECTRIC-SWITCH GUARD; Samuel S. Thompson and Edmond J. Le Blond, Minneapolis, Minn. App. filed May 15, 1916. Forms the casing so that it is adjustable in length to fit within any service box over any size fuse block.

1,247,210. ELECTRIC HEATER; Horatio A. Black, Topeka, Kan. App. filed June 11, 1917. Portable.

1,247,286. ELECTRICAL HEATING UNION; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Jan. 25, 1917. Of the exposed resistor type.

1,247,297. ELECTRIC MACHINE; Frans G. Liljenroth, Westeras, Sweden. App. filed May 20, 1916. To construct commutators so that an increased resistance to discharges between the different bars may be obtained.

1,247,317. LIQUID GAGE; Tetsushiro Nakamigawa, New York, N. Y. App. filed Feb. 28, 1916. Provides a gage which will register the height of a liquid in a tank at some distant point.

1,247,337. ALUMINOUS ABRASIVE; Lewis E. Saunders and Ray Hill White, Niagara Falls, N. Y. App. filed Feb. 12, 1917. Improvements.

1,247,343. CONDENSER TYPE SUSPENSION INSULATOR; Sol S. Sonneborn, Brooklyn, N. Y. App. filed Feb. 10, 1917. Combines in one structure means for distributing electrostatic stress in an effective and efficient manner, providing high puncture strength, providing adequate leakage surface, providing dielectric contour lines of dielectric stress, providing extreme mechanical strength, and many special combinations of these features.

1,247,446. CONTROLLER; Charles L. Perry, Schenectady, N. Y. App. filed Sept. 21, 1916. The spacing between the successive operative positions of the controller and the spacing between the various contacts are materially less than has heretofore been considered necessary.

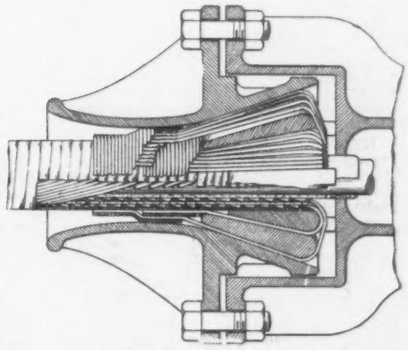
1,247,468. ELECTRIC SWITCH; George B. Thomas, Bridgeport, Conn. App. filed May 15, 1917. Push-button.

1,247,492. LAMP-SOCKET CASING; Reuben B. Benjamin, Chicago, Ill. App. filed April 19, 1912. Means for securing the cap and the shell together.

1,247,501. APPARATUS FOR WELDING; Harry E. Butcher, Cleveland, Ohio. App. filed March 18, 1915. Electric current as the heating agent.

1,247,531. SUPPORT FOR LINE WIRES; Vernon Head, Alexander, Tex. App. filed June 10, 1916. Improvements.

1,247,555. FUSE PULLER; Eugene H. Lowe, Modesto, Cal. App. filed April 27, 1917. Provides mechanism in connection with the ordinary fuse plug for permitting it to be engaged by the usual threaded insulator pin, to permit the withdrawal or replacement of the plug without requiring the same to be touched by the hands of the operator.



1,246,964—Electric Cable

1,247,566. STEAM UTILIZING PLANT; Thomas D. Nuttall, Bury, England. App. filed May 5, 1915. Relates to apparatus employing steam both for motive power and for drying or other analogous purpose, in cases where two or more machines and their adjuncts are employed.

1,247,576. CIGAR-VENDING MACHINE; Jesse T. Robinson, Montgomery, Ala. App. filed Oct. 23, 1916. Coin-controlled.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION, Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City. Annual meeting, Jan. 14, 1918.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Pittsburgh, Dec. 27-29, 1917.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary - treasurer, Roy B. Fowles, Pine Bluff, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, J. E. Wilson, 263 Summer St., Boston, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo. Annual meeting, Jan. 19, 1918.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, J. C. Staff, 578 Jackson St. Milwaukee, Wis.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting, May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga. Annual meeting June, 1918, Tybee Island, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill. Annual meeting, Chicago, January, 1918.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn. Annual convention, January, 1918, Minneapolis.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION, affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekum Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beech St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex. Annual meeting, April, 1918.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill. Annual meeting, Jan. 29-31, 1918, Memphis, Tenn.

WESTERN SOCIETY OF ENGINEERS. ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, March, 1918.